ARCHITECTURE

Incorporating Architectural Technology February 1988 Five Dollars

fashion first!

frost

Acoustone Ceiling Panels

Textured understatement never looked better overhead.

New Frost pattern in the ACOUSTONE® ceiling collection earns a special niche among today's finer natural textures. Its unique low key surface, enhanced by soft shadow line edges, provides visual harmony to the eye; just as an NRC range of .70 to .80 offers comfort to the ear. Available in 2'x2' and 12"x12" sizes, these superior mineral fiber products deliver a flame spread rating of 15; install easily in standard or narrow grids. Available in Canada. See our representative. Or write to **USG Interiors, Inc.,** at 101 S. Wacker Dr., Chicago, IL 60606-4385, Dept. **A 288**

New Strata pattern in ACOUSTONE® ceilings brings subtle linear interest to 2' x 2' panels.

See folder in Sweet's General Building File

Circle 2 on information card

USG **Interior Systems**

He thought he was finished with this job. But the non-Sloan flush valves he originally specified didn't work right. They kept pulling loose at the stop and wouldn't stay in adjustment. They leaked at the handle, at the main seal, and they were impossible to regulate.

It's true he saved the building owner a few dollars on the substitute valves. But that really doesn't mean much now. All of the valves have to be replaced, and he's right back where he started. With one important exception, of course.

This time he specified Sloan flushometers, what he should have done in the first place. Unlike substitute valves, Sloan flushometers are built to last. And last.

In fact, today an increasing number of buildings equipped with substitute products are being refitted with Sloan flushometers. Because Sloan's rugged, tamper-proof flush valve design assures quiet, dependable operation. Consistently. And with only minimal, routine maintenance, Sloan flushometers provide efficient service for years—an important consideration.

Because unless a flush valve says "Sloan," there's no telling how much time or money it will take to get the job done right. So why take a gamble on look-alike products? Put the odds in your favor, and specify Sloan. The first time.

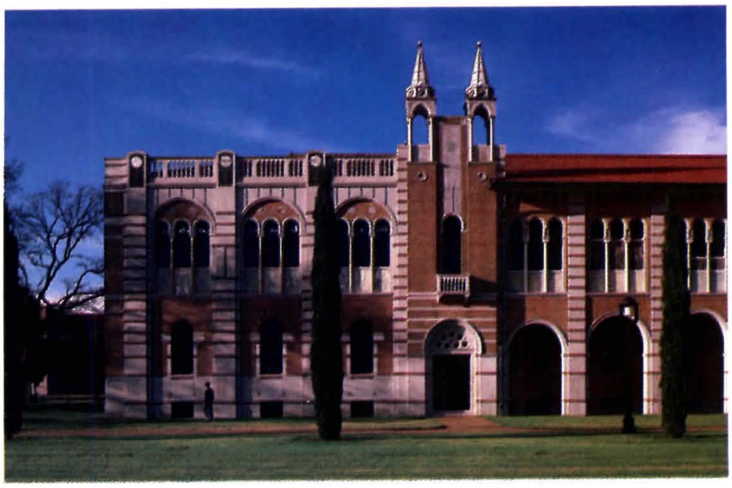
SLOAN VALVE COMPANY
10500 Seymour Avenue, Franklin Park, IL 60131
A Tradition of Quality and Pride

Circle 4 on information card

CONTENTS

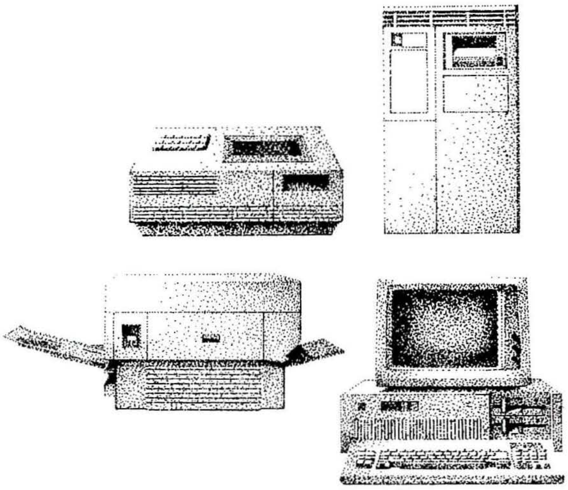
Page 44

Page 82



Page 62

ARCHITECTURE, publication number ISSN0746-0554, official magazine of the American Institute of Architects, is published monthly by the American Institute of Architects at 1735 New York Ave. N.W., Washington, D.C. 20006. **Individual subscriptions:** U.S. and its possessions: $37 for one year, $55 for two years, $72 for three years. Canada: $43 for one year, $63 for two years, $82 for three years. Foreign: $61 for one year, $103 for two years, $145 for three years. Single copies, $5 each (except for May and September issues, which are $10). Publisher reserves the right to refuse unqualified subscriptions. For subscriptions: write circulation department, ARCHITECTURE, 1735 New York Ave. N.W., Washington, D.C., 20006; allow eight weeks. Quotations on reprints of articles available. Microfilm copies available from University Microfilm, 300 N. Zeeb Road, Ann Arbor, Mich. 48106. Referenced in The Architectural Index, Architectural Periodicals Index, Art Index, Avery Index to Architectural Periodicals. Second class postage paid at Washington, D.C., and additional mailing offices. VOL. 77, NO. 2.



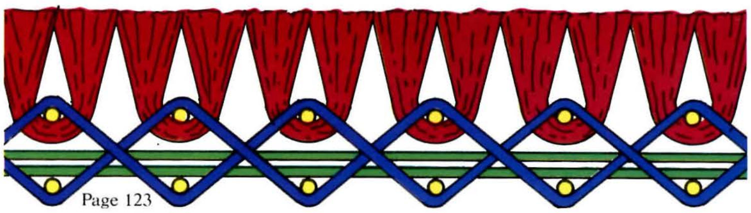
Page 112

Cover

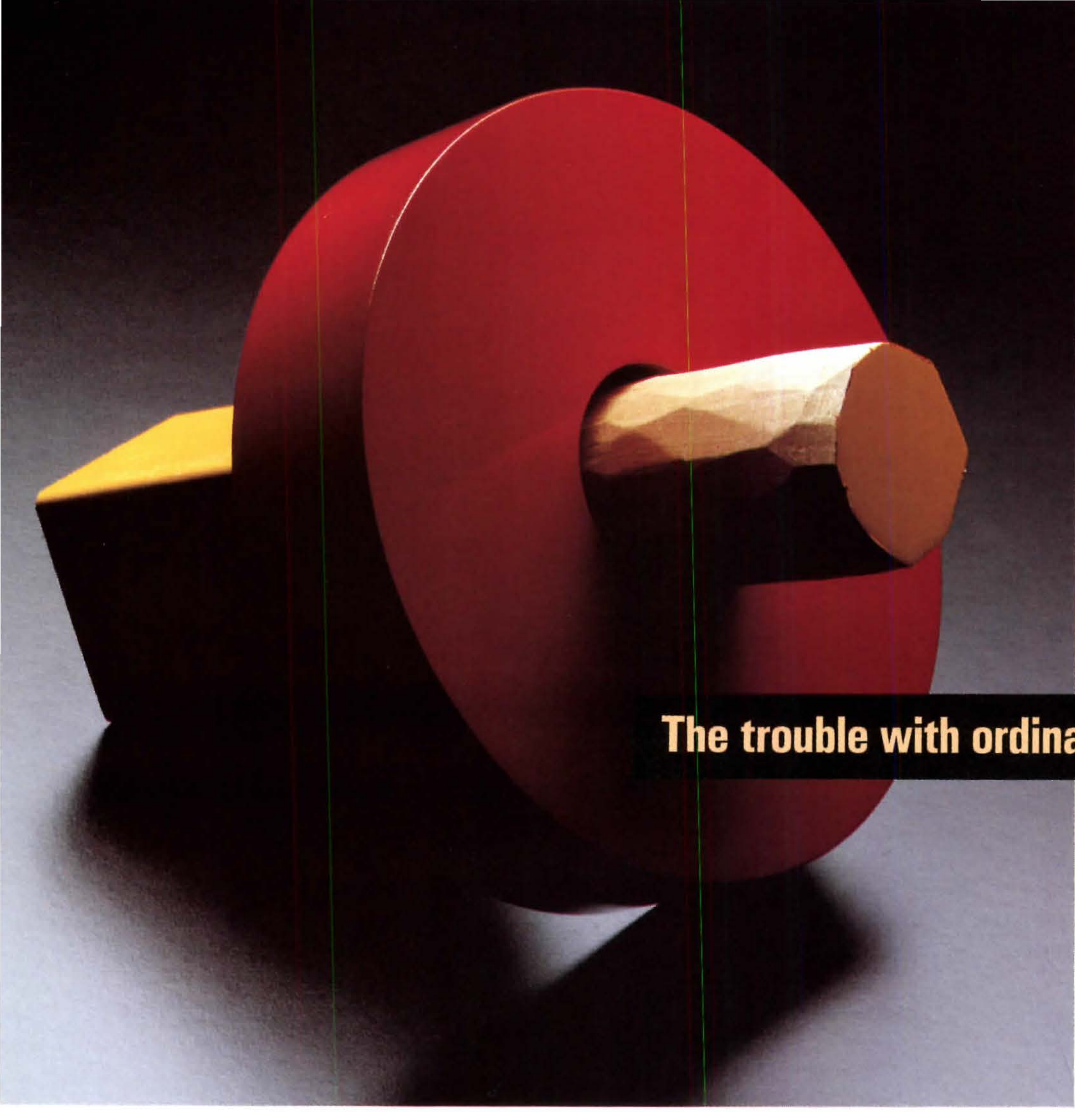
Sumner Center in Washington, D.C., by Hartman Cox Architects (see page 44). Typical of the firm's designs, Sumner knits together old buildings or building parts— here, two old schools on the edges of the photo—with new historicist construction— the entrance in the center of the photo. Photograph © Peter Aaron/ESTO.

News

Technology & Practice



Page 123



The trouble with ordinary furniture systems.

Your client wants one design statement throughout the office—on a tight budget. You know that's practically impossible, but…

Or, your client wants to merge three divisions into one and install a furniture system with a high-profile design statement—but keep all existing furniture. You can visualize the aesthetic disaster, but…

Or, your client thinks that by just putting a hot new look into a cold old building, you can transform it into a silk purse. You know better, but…

So you compromise, compromise, compromise.

No longer.

Introducing new **Elective Elements.**®

A furniture system that gives you literally thousands of combinations to play with. A choice of wood or non-wood components. A list

Circle 6 on information card

of surface materials that includes eighty-three fabric selections, eleven wood veneers, six laminates, and eight paint colors. Even the option of radial or rectilinear top caps and worksurface edges. Not to mention sophisticated wire and cable management. The result: unheard-of design flexibility.

The job of specification, installation, and reconfiguration is a cinch —in the Steelcase tradition. Also worth noting: the price spread between wood and non-wood components means your clients can afford to use new **Elective Elements** top to bottom, front to back.

No trouble.

Stow&Davis

A Division of Steelcase Inc.
The Office Environment Company

For more information, call 1-800-447-4700

EVENTS

Mar. 1-3: Restaurant Hotel International Design Exposition and Conference, Chicago. Contact: The National Expositions Co., 15 W. 39th St., New York, N.Y. 10019.
Mar. 2: Course on the Model Guide Specifications for Asbestos Abatement and Management in Buildings, Chicago. Contact: University of Illinois at Chicago, Conferences and Institutes, 912 S. Wood St., Chicago, Ill. 60612.
Mar. 2-5: AIA/Royal Institute of British Architects International Conference on "Remaking Cities," Pittsburgh. Contact: Charles Zucker at Institute headquarters, (202) 626-7532.
Mar. 5: Seminar entitled "Taliesin—New Directions," Scottsdale, Ariz. Contact: Susan Lockhart, Frank Lloyd Wright Foundation, Taliesin West, Scottsdale, Ariz. 85261.
Mar. 7-8: Modular Housing Symposium, Anaheim, Calif. Contact: Shep Robinson, Manufactured Housing Newsletter, Box 12307, Barrington, Ill. 60011.
Mar. 8-12: Conference on "Making Cities Livable," Charleston, S.C. Contact: Suzanne Crowhurst Lennard, Center for Urban Well-Being, Box QQQ, Southampton, N.Y. 11968.
Mar. 9-12: AIA Committee on Architecture for Justice meeting entitled "Security '88 Update—Feeling Secure About Security," Newport Beach, Calif. Contact: Mike Cohn at Institute headquarters, (202) 626-7366.
Mar. 15: Baltimore Chapter/AIA lecture series on "Building a Tradition: Regionalism and American Architecture." Contact: Michelle Trageser, Baltimore Chapter/AIA, 24 W. Saratoga St., Baltimore, Md. 21201.
Mar. 17-19: AIA Practice Committee/AIA Committee on Architects in Government joint meeting, on "Working Together for Better Public Architecture," Washington, D.C. Contact: Christopher Clark, (202) 626-7537, or Charlotte Franklin, (202) 626-7410, at Institute headquarters.
Mar. 18-20: Technology Executives Conference, Dallas. Contact: United Engineering Center, 345 E. 47th St., New York, N.Y. 10017.
Mar. 20-24: The National Computer Graphics Association Annual Conference and Exposition, Anaheim, Calif. Contact: Sharon Sutton, NCGA, 2722 Merrilee Dr., Suite 200, Fairfax, Va. 22031.
Mar. 22-24: International Conference on Reducing Fire Risk, Cambridge, England. Contact: B.J. Hill, Interflam Conference Secretariat, 4 Broughton Gardens, Belfast, Northern Ireland, BT6 OBB.
Mar. 24-27: Symposium on "Preserving Wright's Heritage," Ann Arbor, Mich. Contact: Prairie House, Domino's Farms, 30 Frank Lloyd Wright Dr., P.O. Box 997, Ann Arbor, Mich. 48106-0997.
May 15-18: AIA Annual Convention, New York City. Contact: John Gaillard at Institute headquarters, (202) 626-7396.

LETTERS

A Different View: As the erstwhile editor of both the *Architectural Forum* and of *Architecture Plus,* I was interested in what you had to say about the architectural press in America over the past 75 years—specifically about who did what, when, first, best, most consistently, and most effectively [Dec. '87, page 72].

Needless to say, those of us who were there for a good part of that time may have a view of those events that differs from yours. In any case, it would take much too long to correct some of your misstatements, omissions, and misinterpretations. It is all in print, for anyone to see who cares to get it straight.

I do want to make one correction that is important not only to me, but also to a number of close friends and former associates. You state that, in 1973, "the *Forum* was further demoralized as several staff members left it to join the newly formed *Architecture Plus.* That is quite incorrect. The truth is that I left the *Architectural Forum* because there were serious conflicts with our then publisher; and I was joined by my *entire* editorial staff. We walked out to start a new magazine—*Architecture Plus*—and had an absolutely wonderful time with it. (I think it showed in what we produced.) The only editorial employee who remained behind was a writer I had hired a few months earlier to help out with a special issue. He was offered the editorship (there was no one else left), and he accepted. A few months later, the *Forum* ceased publication.

The rest of us spent the next two or three years producing what many people thought was a very lively magazine—at least as lively as the old *Architectural Forum* under the likes of Howard Myers, Henry Wright, George Nelson, and Douglas Haskell, who had made the rest of the U.S. architectural press look pretty silly through the decades when they were in charge. *Architecture Plus,* during its brief existence, won every conceivable editorial award and failed commercially because the U.S. economy went into recession in the early 1970s.

Incidentally, I was amazed by your announcement that the "*Architectural Forum* ... was transformed into today's ARCHITECTURE." Are you sure?

Peter Blake
Washington, D.C.

The writer, Andrea Oppenheimer Dean, responds: I should indeed have described the Forum*'s condition in 1973 as "eviscerated" rather than "demoralized" and should have explained that the backbone of its staff left to found (not join)* Architecture Plus. *But I don't understand my respected friend Peter Blake's other criticisms of my article. He feels that I overlooked* Architecture Plus. *Did he read the line describing it as "a lively, highly professional, international design publication, which, for financial reasons, lasted only two years"? He thinks I said that* Architectural Forum ... *was transformed into today's* ARCHITECTURE.*" What I wrote was that* "Architectural Forum ... *was gradually replaced as the* AIA JOURNAL *was transformed into today's* ARCHITECTURE.*" Perhaps I should have said "replaced in spirit." Is there a reason I haven't grasped why Blake is so angry?*

'Careful but Fair': Thank you for your careful but fair article, "Seventy-five Turbulent Years of American Architecture" [Dec. '87, page 72]. To recognize how off-base the architectural press has been (and continues to be, in my opinion) brings hope to architects who are struggling against "their latest pronouncements."

I continue to find ARCHITECTURE stimulating and willing to "take on" the purveyors of fads in a fair and sensible way.

Thaddeus E. Kusmierski
Berkeley, Calif.

Smithsonian Landscaping: Congratulations on your fine coverage of the Smithsonian garden and museum complex (Nov. '87, page 42). While I am the first to appreciate and acknowledge the input of Jean-Paul Carlhian in the garden design, I want to point out that many others played a role in the formulation of this very special place.

Sasaki Associates Inc., as the landscape architect of record, has been involved in the project since the initial interview and has worked closely with Jean-Paul over the last few years to make the garden a reality. In addition, New York landscape architect Lester Collins and Smithsonian Horticulture Office Director James Buckler also participated in this collaborative effort.

While I realize that your focus is on architecture and architects, in a project as important as this I feel it is appropriate to credit all those who were essential to its creation.

Stuart O. Dawson, Principal
Sasaki Associates Inc.
Watertown, Mass.

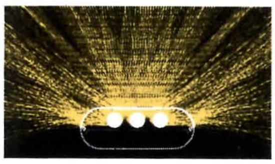
Gropius's Appreciation of Le Corbusier: Inspired by Robert Campbell's excellent article on Le Corbusier's Carpenter Center for the Visual Arts at Harvard [Oct. '87, page 36], I submit the following:

On Aug. 27, 1965, Le Corbusier died while swimming alone in the Mediterranean. On Oct. 9, Gropius spoke in homage at the Carpenter Center: "Le Corbusier's death has shaken the world, for he was a phenomenon of nature, a universal genius. . . . A great prophet, blessed and blessing, went into eternity."

Chester Nagel, FAIA Emeritus
Denver

Amplification: Charles Pfister Inc. was design consultant for the Monadnock Building renovation in San Francisco (see Nov. '87, page 76).

The first fixture designed specifically for today's small office



Very wide spread distribution covers whole ceiling, illuminates walls.

The Peerless Small Office Fixture makes a real difference in the office environment.

It reduces reflections on VDT screens. It softens hard shadows, saves energy and makes the office seem better lit.

It achieves all this as a result of some very specific applied engineering. The Small Office Fixture differs from other indirect fixtures in the amount of light it throws to the side.

Its lensed optical system has the ability to produce an exceptionally wide spread indirect distribution. A single 8′ long fixture can turn the ceiling and walls of a 10′ x 15′ office into a single, softly glowing light source.

Under an average 8′6″ office ceiling, a lensed or parabolic down light—or just about any other practical lighting solution—creates a bright spot in a dark ceiling.

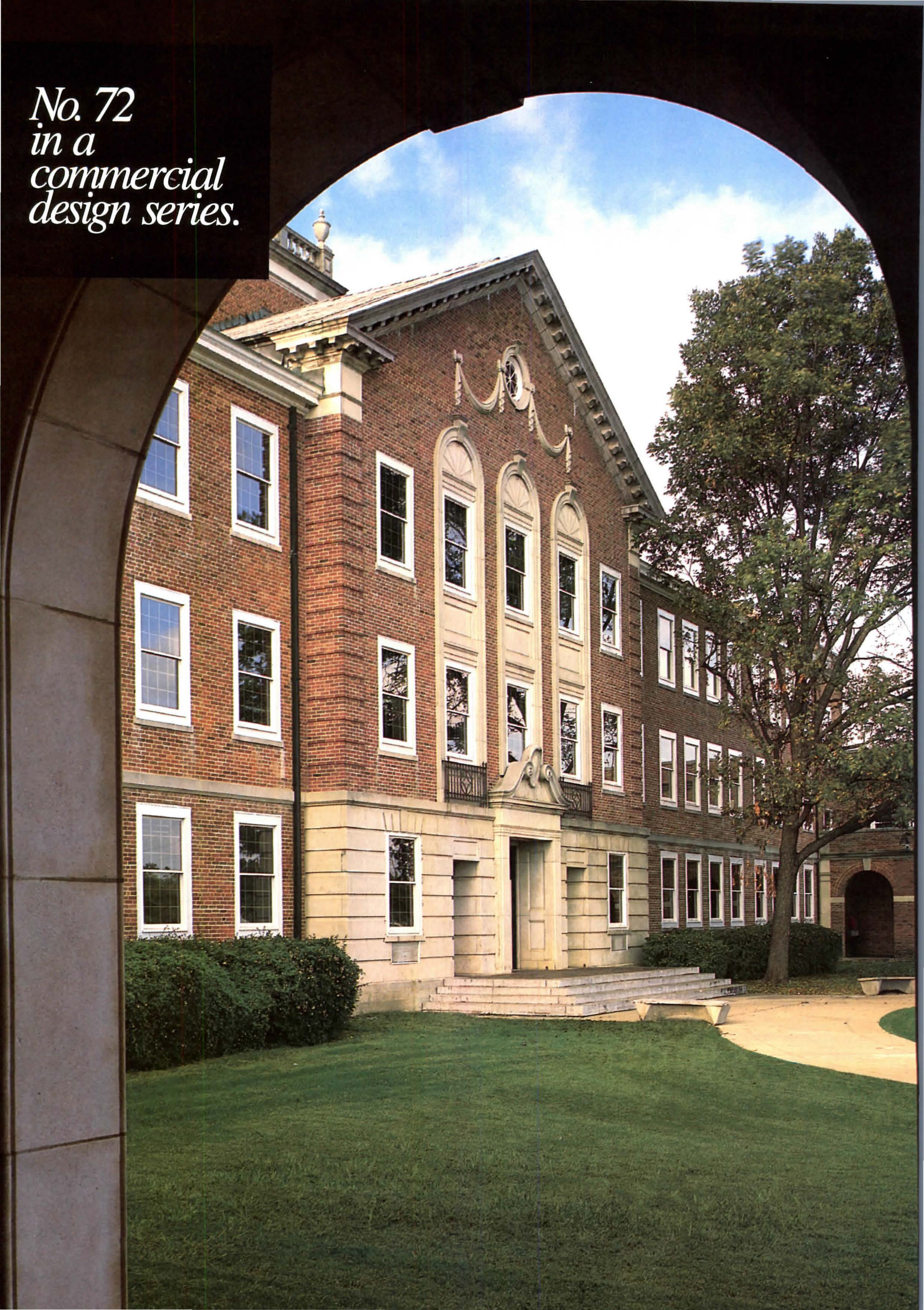
This bright spot bounces back into your eyes off any reflective surface: a desk top, a VDT or this magazine page. It also makes the rest of the office seem dark by comparison.

The unique optics in the Peerless Small Office Fixture make the entire office seem brighter and better-lit. You can see the truth of this claim in a booklet called "Lighting the Small Office" that offers a side by side comparison of the four most commonly used office lighting systems.

Just ask and we'll send you the booklet along with complete product information on the Small Office Fixture. Because the more you know about this specific problem, the better you'll understand why we developed this specific lighting system.

PEERLESS®

If you'd like to see the Small Office Fixture installed in an actual office, write on your letterhead to Peerless Lighting, Box 2556, Berkeley CA 94702-0552. (415) 845-2760.

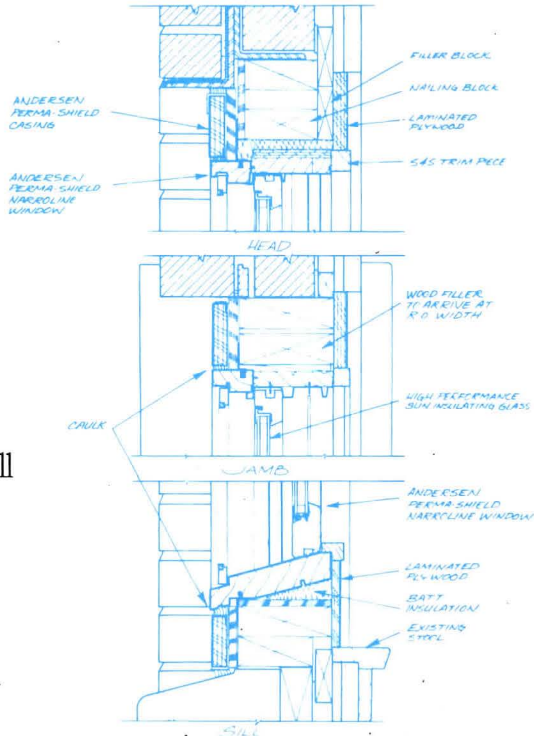

No. 72
in a
commercial
design series.

THE SMART WAY TO UPDATE AN OLD SCHOOL AND STILL KEEP IT TRADITIONAL.

This most impressive structure, located in Fort Worth, Texas, is Arlington Heights High School. A local landmark as much admired today as when it was built half a century ago.

When it came time to replace the worn-out original windows, school district officials wisely decided to install Andersen® Perma-Shield® Narroline® windows.

A prime concern was to preserve the historic architectural style of the building. It's plain to see that the Narroline double-hung windows—with their clean, simple lines—tie in very naturally. Almost as if they had been there all along.



Esthetic values aside, Andersen windows provide very material benefits. Starting with energy efficiency.

In this case, the windows are equipped with our High Performance Sun insulating glass—expressly developed for use in hot-climate areas.

The officials were particularly impressed with the shading coefficient of this revolutionary glass—which in effect helps turn hot Texas sun into cool daylight. Further, the windows easily met government specifications that qualified the project for federal energy credit.

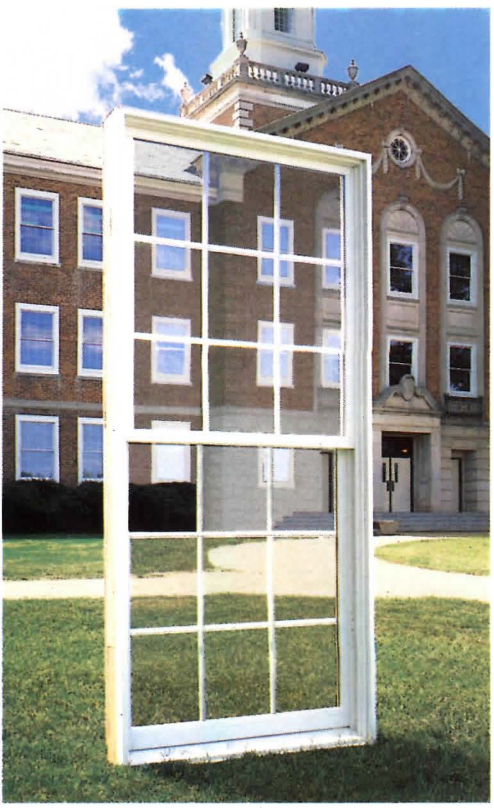
All Andersen windows far exceed industry standards for weathertightness*—which also helps keep energy bills down.

Maintenance costs are minimized, too—because our Perma-Shield® vinyl exteriors never need painting or puttying. The removable, one-piece Perma-Fit grilles also make window cleaning easier.

Whether you lean toward old or new schools of architecture, count on Andersen windows to be totally in keeping with your plans.

For more details, call your Andersen distributor or see Sweet's File 08610/AND. Or write Andersen Corp., Box 12, Bayport, MN 55003.

*NWMA I.S. 2-80



Arlington Heights High School
Fort Worth, Texas

Administration: Fort Worth School District

Project work: School district maintenance and carpenter shop personnel installed all the Narroline windows and trimmed them out with Perma-Shield® casing.

Come home to quality.

Andersen Windows · Patio Doors ™

Andersen

Circle 14 on information card

NEWS

Controversies

SOM/NY Replaces Safdie for Coliseum Site Development

A heated debate in New York City over plans for a major mixed-use project on Columbus Circle entered a new phase in mid-December when the developer, Boston Properties, announced that the original architect, Moshe Safdie, AIA, had resigned and had been replaced by David Childs, FAIA, of Skidmore, Owings & Merrill. In the two and a half years since Safdie's scheme was selected, the story of the Columbus Circle site has been as much about litigation, economic conditions, and financial maneuvering, as about architecture; at present, the situation remains unresolved.

The controversy began on Feb. 4, 1985, when New York City issued a request for proposals to build an enormous development on the site of the obsolete coliseum convention center. Located at the southwest corner of Central Park, the 149,350-square-foot parcel was the largest to come on the midtown market in 50 years.

The city's request stipulated: "The criteria for selection will include: (1) the amount of the purchase price offered, which will be the primary consideration."

On July 11, 1985, Boston Properties and Salomon Bros. Inc., with a scheme by Safdie, were selected as joint developers. Together, they offered $455.1 million for the 3.4-acre site—the highest per-acre price ever paid for U.S. real estate.

Three major Manhattan streets converge at Columbus Circle—the cardo of Central Park West, the decumanus of 59th Street, and the diagonal of Broadway. Edward Durell Stone's Moorish, insular Huntington Hartford Gallery of Modern Art (1965) occupies the southern side of the circle; Thomas E. Stanley's soaringly banal Gulf + Western building (1970) the northern.

In 1982, New York's City Planning Commission recommended and the city's Board of Estimate approved revised zoning that shifted bonus incentives from Manhattan's overbuilt East Side to the relatively underdeveloped West Side, including the coliseum site. In 1979, New York Governor Hugh Carey signed legislation authorizing development of the Jacob Javits Convention Center; opened in 1986, the expansive "crystal palace" of James Ingo Freed, FAIA, rendered obsolete the Columbus Circle center and paved the way for redevelopment of the coliseum site.

Design guidelines for the site were developed by Cooper Eckstut Associates. The 11 lines of guidelines mentioned little more than that the design should "reinforce the civic importance of the Circle" and "relate to certain elements and features of the Gulf + Western and Huntington Hartford buildings."

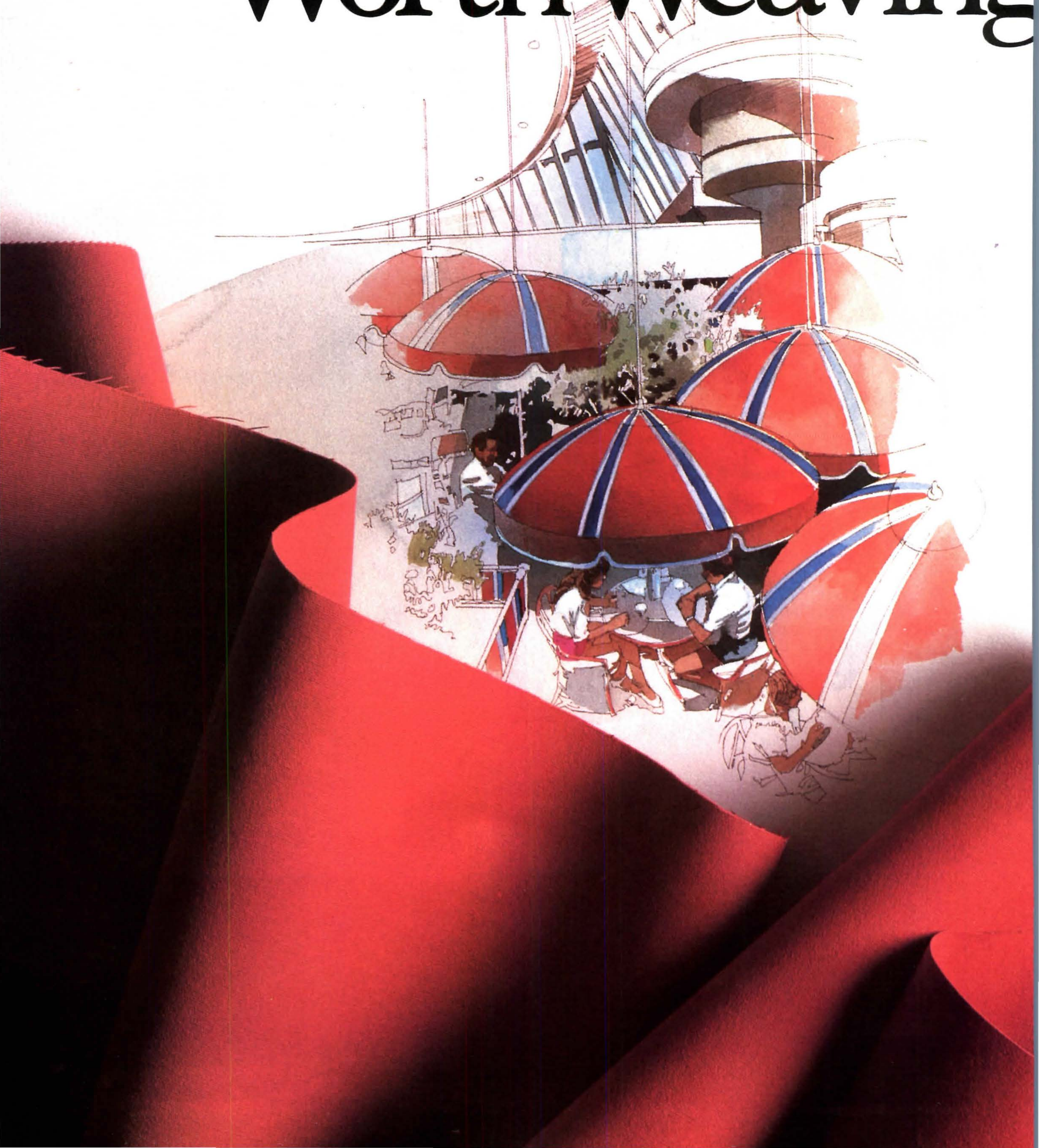
More than any architect or planner, the February 1985 request for proposals was the faceless designer of the 13 proposals submitted and accepted for consideration. Although designed by "name" architects, most of the proposals were somewhat less than brilliant. Answering the call for a masonry curve responding to Columbus Circle, all 13 were similar at their base. Where the design guidelines were looser—at the critical transition between base and top, and in the tower tops themselves—the designs became more creative. Five of the proposals called for tall towers (three of them the world's tallest); six called for slabs in styles ranging from facetious constructivism to Rockefeller Center clones; two called for low masses.

At a public presentation before the Architectural League of New York, Raul de Armas, AIA, of SOM/New York, designer of one of the low masses, was commended by visiting architect and critic Edmund N. Bacon, FAIA, for a building

continued on page 17

Simulation of the mile-long shadow that would have been cast across Central Park by Safdie's 925-foot tower.

At Last An Indo
Worth Weaving



/Outdoor Fabric nto Your Designs.

<u>*It's The First Flame-Retardant Canvas You Can Warm Up To.*</u>

Inside and out, there's nothing like awnings and decorative fabric treatments to add interest to commercial settings. The only problem is finding fabric that can measure up to your expectations as well as it does to fire codes. That's because most flame-retardant materials are coated with resins or made out of vinyl, making them shiny or stiff or both. Which is why Sunbrella Firesist® is such a breakthrough for designers.

Our material is woven entirely from self-extinguishing fibers — woven so it has the look and feel of traditional canvas. And yet its fibers are made of color-pigmented modacrylic. So they last much longer than any duck or cotton. And they provide rich, saturated hues, too. Hues that are colorfast so they can't be faded or washed out.

In addition, Sunbrella Firesist won't crack, peel, harden, mildew or rot. And it's highly soil resistant. In fact, we're so sure Sunbrella Firesist will live up to these promises, it comes with a 5-year limited warranty. And it has another advantage, too: It's highly breathable, making it very energy efficient.

Of course, Sunbrella Firesist meets the toughest codes like the requirements of the National Fire Protection Association and the California Fire Marshal's test. Which means you can specify canvas treatments such as awnings, canopies or decorative panels just about anywhere. And finally get the results you want. So find out about our wide selection of solids and patterns. Contact your local fabricator or Glen Raven Mills, Inc., Glen Raven, NC 27215, 919/227-6211. ®Sunbrella Firesist is a registered trademark of Glen Raven Mills, Inc. ®SEF-PLUS is a registered trademark of Monsanto Chemical Company.

SEF PLUS® Modacrylic Fiber by Monsanto

Sunbrella Firesist®

Circle 18 on information card

Sensor Operated
Another first from Haws.

HCBF7HO
Stainless Steel

The First Water Coolers To Offer TOUCH-FREE Operation

Introducing "Hands-Off" water coolers from Haws. "Hands-Off" coolers feature a patented electronic sensor that activates the water stream as soon as a user comes within range. A built-in timer stops the water flow automatically if the sensor is blocked for more than 30 seconds, thus discouraging tampering and preventing damage to the sensor itself. Another protective feature—a time-delay mechanism—prevents accidental activation by passers-by. Now health care facilities, office complexes and all indoor public areas can be designed with the ultimate in barrier-free convenience.

"Hands-Off," the "Smart" Water Coolers

Models HWCF8HO, HWCF8-2HO, HWDFS8HO, HWDFS8-2HO and HWCT8HO

These sleek, wall-mounted units each feature a receptor, backplate and grille constructed of heavy-gauge stainless steel with #4 Satin finish. They're also available in Stainless Steel with a Sienna Bronze™ finish.

Model HCBF7HO

This handsome wall-mounted model is manufactured of heavy-gauge steel and finished in Kenyan Beige Enamel. Optional finishes include: Alabaster Enamel; Expresso Enamel; Metallic Bronze Enamel; Cork Vinyl; Stainless Steel; and Stainless Steel with Autumn Bronze.™

HWDFS8HO

HCBF7HO
Kenyan Beige

Envision the possibilities!

Haws®

Haws Drinking Faucet Company
P.O. Box 1999, Berkeley, CA 94701
(415) 525-5801 Telex: 33-6358
Haws AG
Kirchberg/Bern Switzerland

For more information on Haws' new "Hands-Off" water coolers, contact your local Haws representative, see Sweets section 15.7C, or phone the Sweets Buyline.

Circle 20 on information card

Controversies *from page 13*
"contextually, in a class by itself." Michael Graves, FAIA, designer of the other low mass, asked rhetorically, "Honestly now, given your druthers, would you really want to put this much building on that small a site?" In conclusion, panel member Henry Cobb, FAIA, senior partner in I.M. Pei & Partners, commented, "The necessary intervention must take place at the point of determining land values, which in this instance were arbitrary and capricious in the extreme."

Arbitrary, capricious, and not a little avaricious. The official committee that reviewed the 13 proposals included not one design professional. The selection process was in no significant way to incorporate a critical architects' competition; it was, unabashedly, to be a developers' auction.

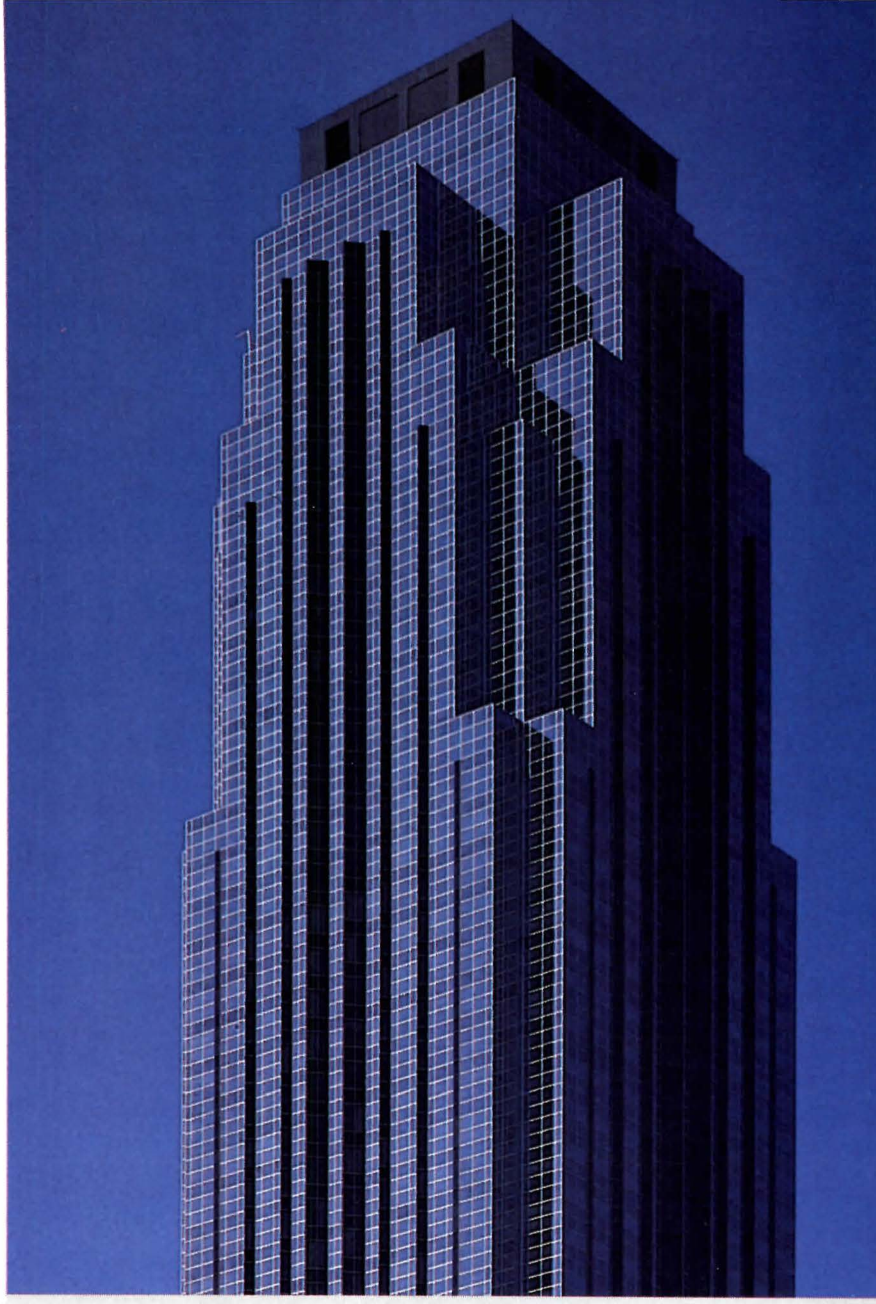
By late June 1985, the city had narrowed the field to the two highest bidders—the New York Land Co. with a bid of $477 million and Boston Properties-Salomon Bros. Inc. at $353 million. Asked to rebid, Mortimer B. Zuckerman, chairman of Boston Properties, came back with an offer of $455.1 million. Although it was $22 million below New York Land's bid, New York City accepted Zuckerman's offer on July 11. New York Land had been linked with real estate dealings of deposed Philippine president Ferdinand E. Marcos; moreover, Salomon Bros. had agreed to make the coliseum site its world headquarters, which therefore would create 3,500 new jobs. The new building would pay $50 million a year in real estate taxes. Zuckerman eventually was to offer $40 million in subway improvements in exchange for a 20 percent floor-area-ratio bonus.

Twice asked what *architecturally* distinguished this design from the dozen other schemes submitted, Mayor Edward Koch both times replied with a dollar figure.

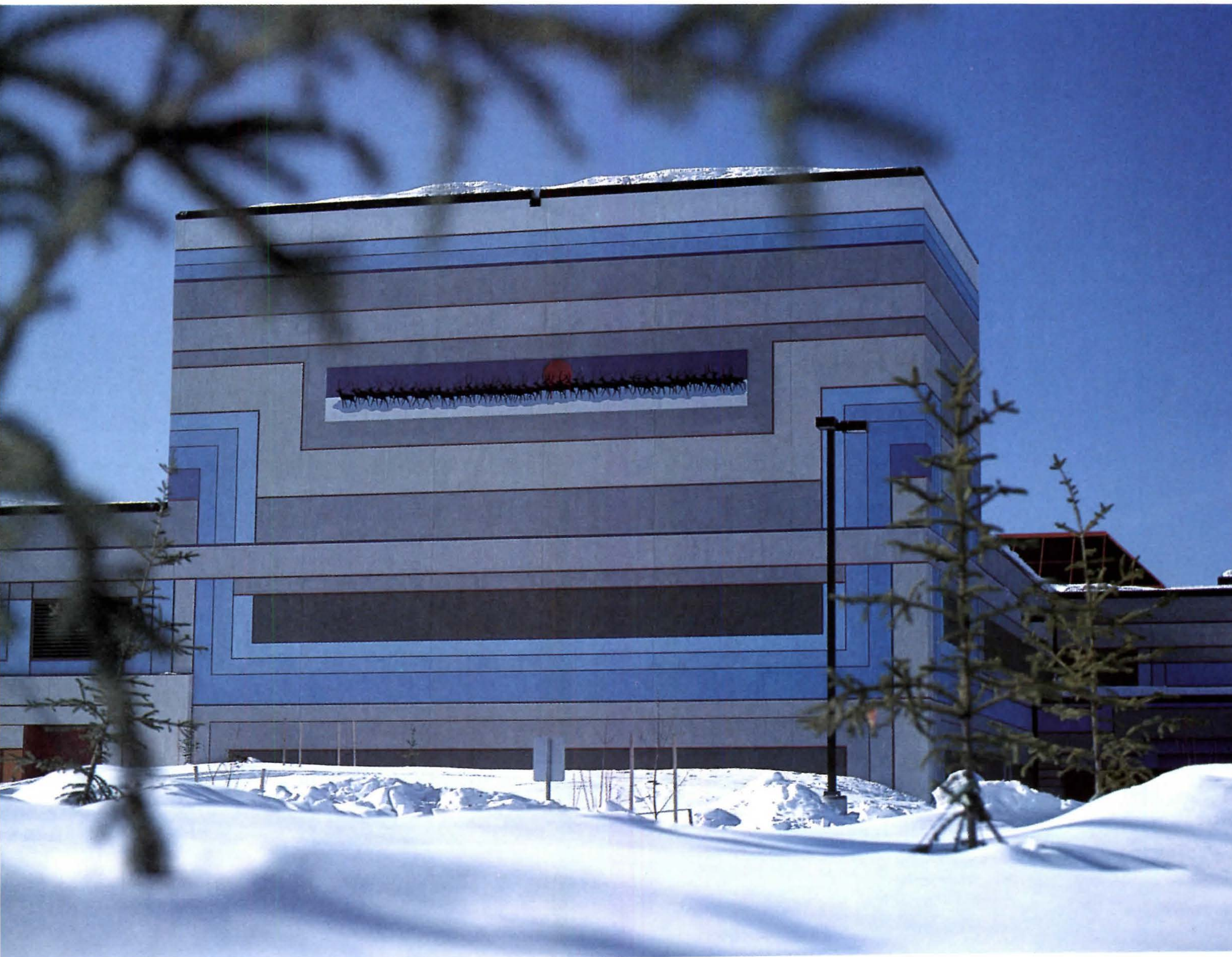
Between 1985 and 1986, Safdie's central ideas remained basically unchanged—asymmetrical towers of 68 and 58 stories to break down the building's mass; a 31-foot-wide slit between the towers engendered by the 59th Street view corridor; and a skylighted, retail arcade curved and scaled to reinforce street life around Columbus Circle. Above the arcade and a multiplex cinema were to be a garden atrium and trading and office floors for Salomon Bros.; above Salomon was to be leased commercial space. A 300-room hotel was to occupy the middle of the towers; 300 luxury apartments—added to the program during the intervening year—the top. Safdie also maintained his emphasis on the diagonal in plan as well as section: the towers' pitched roofs, the setbacks' chamfered corners, the atrium's slanted skylight.

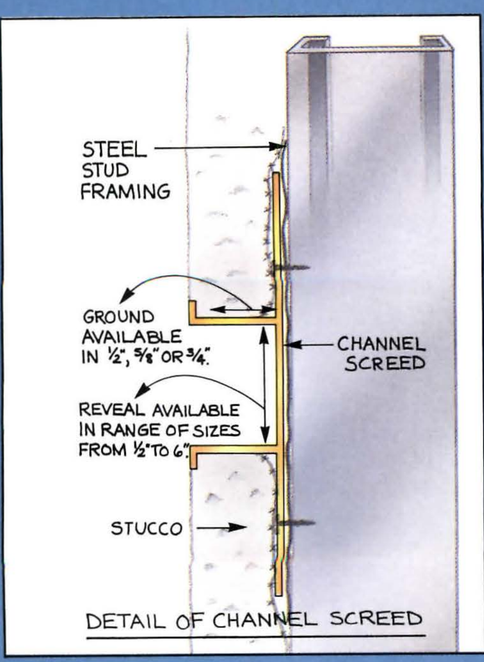
What changed from Safdie's preliminary design was the degree of elevational elaboration. At the top of the towers, apartments were to be identified by either round bay windows or glazed greenhouse corners. In the middle, east and west hotel eleva-

continued on page 19



Fry's Aluminum Architectural Moldings Add a Third Dimension to Your Design





North Pole Senior High School — A silent sentinel in the snow-covered frontiers of Alaska. A symphony of visual impact and originality, made possible with Fry aluminum moldings. Custom extrusions, carefully matche colors, and factory fabricated intersecting pieces allow this design to flow in an uninterrupted fashion.

Fry's other capabilities to aid your unique design include radiused moldings and fabrication enhancements to ease installation. No longer a purely functional product, **Fry aluminum moldings** provide you with design option as limitless as your imagination.

FRY REGLET
Aluminum Architectural Moldings

625 South Palm Avenue
Alhambra, California 91803
(818) 289-4744

2777 Peterson Place
Norcross, Georgia 30071
(404) 441-2337

Look for us in Sweets catalog 09200/Fry.

Controversies *from page 17*
tions were to be expressed as six-story "chevrons" delineating the structure's triangular bracing; north and south elevations were to be expressed as a "shear link grid" of punched rectangular windows. This grid Safdie considered "the year's most significant development."

During an Architectural League presentation, Safdie claimed for himself the prerogative that his design be "assertive —my notion of what a tall buiding should be." To some observers, that architect's notion of anxious angles appeared not only overactive in its articulation but also antagonistic toward its context. Safdie, who has never built in New York, admittedly was encumbered by the need to retain the office building at 10 Columbus Circle and incorporate it within the shorter of his two towers. Nonetheless, the architect's random stacking of masses appeared more derivative of his Montreal "Habitat" than respectful of New York's own skyscraper tradition. Finally—aloof, alone—Safdie's scheme did not much accommodate itself to the context, neither ameliorating the negatives of Columbus Circle's bathetic architecture and chaotic circulation nor integrating the positive of its proximate relation to Central Park.

On June 5, 1987, the Municipal Art Society, the Parks Council, and the New York Metropolitan Chapter of the American Planning Association sued New York City to stop the sale of the coliseum site. The MAS suit charged that "the process by which the development was approved was fundamentally and fatally flawed."

On Oct. 18, MAS held a symbolic protest in Central Park. Called "Stand Against the Shadow," the sunny Sunday afternoon demonstration drew some 1,000 New Yorkers. Lined up from Columbus Circle northeast toward the Metropolitan Museum of Art, the demonstrators one after another unfurled black umbrellas to simulate the mile-long shadow the building would cast.

The following day, Oct. 19, the stock market crashed. Already, on Oct. 12, Salomon had announced that, following $100 million in bond trading losses, it would dismiss 12 percent of its work force and would reassess its global "space requirements." On Oct. 13, Zuckerman announced that he was willing to renegotiate the deal for a project 10 percent smaller. The Koch administration wouldn't hear of it.

On Dec. 4, taking advantage of a "walk clause" in its contract with Boston Properties, Salomon Bros. Inc. formally withdrew from the deal. That same day, Zuckerman and Koch announced a scaled-down version of the project: Coliseum II was sketched in at around 2.2 million square feet and a sale price of some $375 million.

On Dec. 10, acting Justice Edward H. Lehner of the state Supreme Court in Man-
continued on page 21

Controversies *from page 19*

hattan declared "null and void" the 1985 sale of the coliseum site. Responding to the MAS lawsuit, the court found that New York City had acted illegally in making the full purchase price contingent on zoning variances to be decided on by one city agency—the Planning Commission—and approved by another—the Board of Estimate. The city plans to appeal.

The story continues to unfold. As far back as last July, Zuckerman, without informing Safdie, began looking for a replacement architect. On Dec. 16, Zuckerman announced that he and Safdie had "agreed" on the architect's withdrawal from the coliseum site project. In a written statement prepared two days earlier, Safdie noted, "The project has been the subject of such controversy that [Boston Properties has] been under considerable pressure . . . to change every aspect of it including not only the design but also the designer." Also on Dec. 16, Zuckerman announced that David Childs had agreed to become the new architect of the coliseum project.

Partner in charge of the architectural design department at SOM/New York, Childs has in the past worked with Zuckerman on several Washington, D.C., projects. While commenting that "I don't have any preconceptions about the job," Childs noted that the curved, skylighted retail arcade seemed the best part of Safdie's design. Childs also said that only when he knew he'd been given the job and made that 101st visit to the site did he really begin to notice what's "appropriate to the unresolved urban space of Columbus Circle." Speaking in late December, Childs said he felt it was still too early to elaborate.

In early January, City Councilwoman Ruth W. Messinger remarked on the previous design: "We had 44 public meetings on Columbus Circle, but they totally ignored the community input and went ahead with what they wanted to do." Childs has stated that, to the extent time allows, he intends "to include constituency concerns" among his basic design determinants. Childs, moreover, will be working to a revised brief.

On New Year's Eve, New York City and Boston Properties signed a new contract for developing the coliseum site. Replacing the old agreement, which collapsed with Salomon's withdrawal from the deal, the new contract reduces the purchase price for the site to $357 million, payable in one lump sum so that the city collects interest. The price reflects $5 million New York City is paying Zuckerman for costs already incurred. The new contract also reduces the floor area ratio from 18 to 15; that translates into approximately 2.2 million square feet of floor area, or 52 acres rather than the previous 63. In exchange for the reduced floor area, Zuckerman will no longer be required to spend $40 million im-

continued on page 23

A FEW REASONS WHY A 350 TUFFLINE ENTRANCE LIVES UP TO ITS NAME.

AND A FEW REASONS WHY IT HAS TO.

350 Tuffline. Educational tool for the 80's. And beyond. For new and replacement doors at schools, college campuses, and in other high traffic and abuse-prone installations. Tuffline entrances are all their name says they are. Tested in the educational market, Tuffline is offered as single-acting entrances in both singles and pairs to 8′ heights. With durable butts, pivots, closers and panics to resist vulnerability and increase security when school's out. And design options such as Paneline® to customize without compromise.

Tuffline. At the head of the class.

Kawneer

For technical specifications contact:
Kawneer Company, Inc. Department C,
Technology Park-Atlanta,
555 Guthridge Court, Norcross, GA 30092

Circle 32 on information card

Controversies *from page 21*
proving the Columbus Circle subway station. He will, however, be liable to forfeit a $10 million guarantee should he fail to "negotiate in good faith"—that term to be defined by three arbitrators should need arise.

While for both financial and esthetic reasons Zuckerman has no interest in developing a short, squat building, he has said, "The project will certainly not be above 850 feet, and we will look to bring it in as low as we possibly can and still have a good design." He added, "Our intention, obviously, is to allow the architect to do his work."

Concerning the granite already quarried and the steel already fabricated for Safdie's scheme, Boston Properties President Edward H. Linde commented, "At this point, no decision has been made whether we will incorporate those materials in the new design or dispose of them and place no restraints on Childs's design." Regarding a reported $27 million in architect and engineer fees already incurred and uncalculated millions owed lawyers for the MAS lawsuit they lost, Linde said, "Suffice it to say . . . that we have reached a termination agreement with Salomon where they made certain payments and they were relieved of their obligation to be a tenant and a joint venture partner."

New York City would like to have Childs's new design submitted by May and to bring it before the Board of Estimate by late summer. Thereby, however, hangs a conundrum. If, as the city contends, Childs's design is an entirely new one, then either the site is opened to a second round of bidding or developers could sue. If, on the other hand, Childs's design is not new, then the court's decision in the MAS lawsuit still applies and New York City must appeal. The city can't have it both ways.

Combined with Salomon Bros.' economic retrenchment, public opposition succeeded in scaling down an overlarge coliseum site project. Concern over public opposition was also a crucial factor in NBC's recent decision not to relocate to Donald Trump's Television City just west of Columbus Circle. Aware of their power, aroused New Yorkers may have more to say about megaprojects proposed in the future. They may also have a message for greedy municipal officials who behave like the private developers from whom they're supposed to protect the public. Sun and sky and urban space are as important as developer dollars; so are size and scale and quality architecture. A well-designed request for proposals can provide for all those things. City government should draw the line before any architect ever draws a line.

—Sandy Heck

Mr. Heck, a freelance architecture critic living in New York City, is a contributor to the Architectural Review, Connoisseur, A+U, *and the* New York *Times.*

News continued on page 25

Competition Fuels Debate Over New Chicago Public Library

For more than 20 years Chicago has been trying to build a new public library. In the latest turn of events, a controversial design/build competition, which city officials predicted would draw more than 300 submittals, has attracted only six entries. The $140 million library is to be located on a prominent site (shown below) in the city's South Loop.

The competition follows years of debate over the location of a new library after the city outgrew its original 1891 Shepley, Rutan & Coolidge building. This neoclassical landmark has been restored and now houses the city's literature and fine arts collections and the municipal Cultural Center, while the bulk of the city's books have been "temporarily housed" for the past 12 years in a warehouse several blocks to the north. Various schemes have been accepted and then rejected, and several have created their own controversies, including a plan by Holabird & Root to convert the former Goldblatt department store.

The jury met in mid-January and selected five finalists. The lead architects of the five teams are: Murphy/Jahn & Associates; Hammond Beeby & Babka; Skidmore, Owings & Merrill/Chicago with Legoretta Architects; Arthur Erickson Architects; and Lohan Associates. Eisenman/Robertson Architects dropped out before the selections were made. The finalists have three months to prepare design proposals.

The Chicago Chapter/AIA immediately opposed the competition procedures following the announcement last summer. The chapter argued that the city was sacrificing quality architecture for an easily administered, one-step process. In a letter to city officials, Cynthia Weese, AIA, president of the chapter, expressed "grave reservations about the success of the design/build competition" for the library.

The time frame was very narrow, and architects were also required to assume an enormous financial responsibility, which excluded many smaller firms. In response to criticism, the city did increase the honorarium for the runners-up from $50,000 to $100,000, "in recognition of the importance and size of the project."

However, the chapter has repeatedly argued that its primary concern is "the quality of interaction" between client and architect. "The client, whether he be Pope, king, or high-rise office developer, plays a key role in the success of a building—esthetically, programmatically, and economically. The city must take its responsibility as a client seriously," according to a statement.

The chapter has criticized the design/build process even after the six teams were announced. However, Weese, in a second letter, praised the six lead architects, stating "they are all without question well qualified to design a fine building."

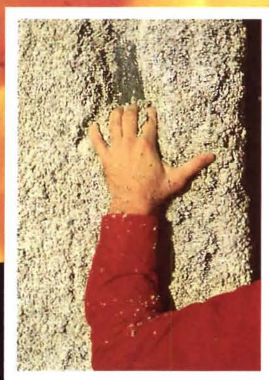
In defense of the competition, Paul Karas, Chicago's public works commissioner, said that the city thought "this might be an opportunity to give the private sector a chance to see if they can do things more quickly and at less cost than we in the public sector can." Opponents argue that city officials are more concerned about the cost overruns that plagued recent major building projects than ensuring that a quality library is built. Critics also argue that the city is not willing to take financial responsibility for the project.

"In effect, the fox is being asked to guard the chickens," the Chicago Chapter said in a position paper. "In the traditional building process, the architect is employed by the owner and is the owner's representive during construction. In design/build...quality control is in the hands of the contractor, his interpretation of how the building is to be finished is binding. This can create many surprises."

In that same paper, the chapter chided the city for "abdicating its role as client in the construction of this building." The chapter also said the new library "should be a direct reflection of the hopes and aspirations of the people of Chicago, not of a private developer or contractor." If the library is not the "world class" building city officials repeatedly have claimed Chicago deserves, those same officials will have to accept the greatest part of the blame.—Lynn Nesmith

News continued on page 28

Thomas Yanul/Chicago



Mineral Wool Sprayed Fiber

Cementitious Monokote

The building inspector has gone. The spray-applied fireproofing has been approved. Now the real testing begins. Electricians, plumbers and carpenters are on-site with wrenches, ladders and hammers. Normal job-site conditions can cause impact damage, abrasion and removal of soft, friable fireproofing materials. Just a small gap can be enough to jeopardize the specified fire-resistance rating.

In-place performance is critical! UL classified Monokote Fireproofing meets or exceeds all recommended levels of performance for in-place strength, durability and resistance to fire and abuse.

Judge for yourself. Compare cementitious Monokote to low density, friable materials. Compare bond to steel, surface hardness, durability, and air erosion. Compare the ability to resist damage from air movement found in elevator shafts that can cause dusting that contaminates sensitive electronic equipment. Compare manufacturer's published minimum standards — you'll find Monokote's are higher across the board.

Finally, compare service. Our national network of Grace professionals provide preliminary design and specification assistance, plus on-site application support when you specify Monokote!

Monokote Fireproofing. Specify anything else, and you're playing with fire.

For more information call (617) 876-1400 ext. 3170 or write W. R. Grace & Co., 62 Whittemore Ave., Cambridge, MA 02140.

GRACE
Construction Products

Circle 42 on information card

Science Academy Study Reveals Greater Radon Cancer Risk

A three-year study conducted by the National Academy of Sciences has determined that the risks of developing lung cancer from exposure to radon are about three times greater than the currently accepted estimates.

Radon, a colorless, odorless gas formed by radioactive decay of uranium in the soil, could be responsible for as many as 13,000 lung cancer deaths annually, according to the new findings. The study also found that the risk to cigarette smokers is "10 or more times greater than in nonsmokers." Smoking has been determined to dramatically multiply an already increased chance of lung disease from other pollutants, such as asbestos. According to the report, smoking does not appear to be simply an added risk but can multiply the risks of radon.

Cosponsored by the Environmental Protection Agency and the Nuclear Regulatory Commission, the study was compiled by the National Research Council of the National Academy of Sciences. The findings of the 12-member committee, headed by Jacob I. Fabrikant, professor of radiology and biophysics at the University of California, Berkeley, indicate a significantly greater problem than did a 1984 study conducted by the National Council on Radiation Protection, which has been widely used by radiation experts. However, these latest survey results correspond with EPA estimates that attribute between 5,000 and 20,000 lung cancer deaths a year to radon exposure.

Health effects other than lung cancer due to exposure to radon and its decay products are largely unstudied, the National Research Council found: "Data are sparse and associations are weak."

Radon is a byproduct of the decay of uranium in rocks and soil, as well as some building materials including concrete and stone. The study reported that, although both natural and manufactured sources of radon in the environment can pose a risk to human health, "the natural sources currently make the largest contribution to human exposure." The report also stated that, "among the natural sources, inhaled radon and radon decay products indoors are the largest contributors to population exposure . . ."

The majority of the council's conclusions were drawn from four epidemiological studies involving more than 22,000 underground miners. The council warned that the conditions under which radon is inhaled in the home may be significantly different from conditions in the mines. In releasing its findings, the council also pointed out that its study addresses effects on health only and does not provide regulatory guidance on exposure levels to radon, saying that such estimates were beyond its charge and expertise.

The radioactive gas is ubiquitous and normally dissipates harmlessly into the environment, but it can accumulate to dangerously high levels in buildings after seeping in through cracks in the foundation and drainpipes. The EPA has set "four picocuries per liter" as the level of radon exposure where concern is warranted and recommends that homeowners take action if radon gas exceeds this level (see March '87, page 85).

In addition, the EPA previously had estimated that 8 to 12 percent of America's 75 million houses might have radon levels greater than these air quality standards. The council's study did not attempt to estimate radon levels in houses and office environments, nor did it estimate the number of buildings affected. However, a survey completed last year found that in 10 states studied the number of houses affected was greater than had been estimated. Recent studies conducted in two suburban counties outside Washington, D.C., found elevated radon levels in 50 percent of the houses tested.

Additional surveys are now under way to determine the extent of the radon problem in this country. The highest indoor levels of radon have been recorded in buildings constructed over a geological formation running northeast from Reading, Pa., up through New Jersey into New York state; this area has been referred to as the "Reading Prong." —Lynn Nesmith

Memphis Architect Develops CADD System for Post Offices

Current U.S. Postal Service plans require that construction documents for a significant percentage of new post offices be derived from a kit of parts on a CADD system.

The Postal Service commissioned the firm Jones Mah Gaskill Rhodes, Memphis, to design seven components—some optional, depending on the size of the post office—so that a design firm that wins a post office commission is able to produce construction documents within three weeks. The Postal Service plans to use the standardized-component design approach for facilities with areas of 5,000 to 28,000 square feet.

The architecture firm created the kit-of-parts design on three CADD systems—GDS (by Infocel, formerly marketed by McDonnell Douglas as McAuto), Autocadd (by Autodesk), and Intergraph—which together accommodate the majority of CADD users, said Martin E. Gorman Jr., AIA, senior vice president of Jones Mah Gaskill Rhodes.

The seven components in the CADD kit of parts are administration space, a service lobby, a postal box lobby, a workroom/support area (the main portion of the space), a loading platform, a covered loading area for mail carriers, and a fuel island. Interior layouts for each module and building massing are standard, although module sizing and exterior cladding material are at the discretion of the project architect and postmaster.

"The kit-of-parts approach will result in a recognizable post office image, and we spent a good deal of time with postal officials representing all five of the Postal Service regions working on a design vocabulary those officials feel will carry the Postal Service into the next century," said firm principal Francis Mah, AIA. "Hand in hand with the image was the desire to set a benchmark of design quality that is applicable to all levels of post office size and, of course, the need to streamline design and construction time," he said.

"One concern we had from the outset was daylighting the workroom area, which is often neglected in post offices," Gorman said. "It's easy to design an elegant lobby, but a pleasing environment in the workroom is a bit more difficult, especially with the optional connections to the other modules and the non-site-specific nature of the design," he said.

Cutoff angles and overhangs minimize direct glare through overhead glazing, and a white roof helps direct additional light to soffits. "We considered southern exposures for clerestory glazing until we realized that most of the work that goes on in a post office is in early morning and late afternoon. Consequently, we specify that the project designer orient glazing to the east and west," Gorman said.

Currently, more than 15 post offices have been bid, from Florida to Oklahoma, that will be designed with the CADD kit of parts. The first of these are scheduled for completion in August 1988.

—Douglas E. Gordon

Awards
Ten Foreign Architects Named Honorary Fellows of AIA

The Institute has named 10 foreign architects to honorary fellowship for their "esteemed character and distinguished achievements." The honor is conferred upon architects who are not U.S. citizens and do not practice in this country. The new honorees will be recognized at AIA's annual convention this May in New York City.

The 10 architects are:

- Lodovico Barbiano di Belgiojoso of Milan, one of the founding principals of the Italian firm Banfi, Belgiojoso, Peressutti & Rogers and professor of design in Venice and later in Milan.
- Trevor Dannatt, London architect in private practice since 1952, part-time professor at the University of Manchester, and editor of the British *Architects' Yearbook.*
- Pierre-André Dufetel, Paris architect, author and historian, president of the French Academy of Architecture from 1967 to '82, vice president of the French division of the International Union of Architects, and recipient of the Grand Prix de Rome d'Architecture.
- Yehya Mohamed Eid, professor of architecture at Ain Shams University in Cairo since 1970, vice president of the Society of Egyptian Architects, and editor of the magazine of the Egyptian Architects Association.
- Roderick Peter Hackney, leading proponent in England of community-based architectural practice and advocate of "self-help" architecture, visiting professor of architecture, president-elect of the Royal Institute of British Architects, and first vice president of UIA.
- Tao Ho, founder of his own firm in Hong Kong in 1968, professor of architecture at the University of Hong Kong since 1979, and establisher of the first Chinese government-approved, joint-venture, private architecture practice in China in 1985.
- Matti K. Makinen, who practiced in various architectural offices in Helsinki (including one of Finland's largest firms, Suunnittelurengas) before being named general director of the National Board of Buildings in Finland, professor of architecture at Oulu University, and president of the Finnish Association of Architects from 1978 to '81.
- Ernst A. Plischke, Viennese architect who spent 24 years in New Zealand before returning to his native Austria to head the master school at the University of Vienna in 1963.
- Kazuo Shinohara, Japanese architect, professor of architecture at Tokyo Institute of Technology, and visiting professor at Yale University in 1984.
- Terence J. Williams of Victoria, British Columbia, president of the Royal Architectural Institute of Canada.

© Steve Rosenthal

The Boston firm Kallmann McKinnell & Wood, architect of the 1982 AIA honor award winning American Academy of Arts and Sciences in Cambridge, Mass. (above), has won the 1987 Louis Sullivan award for architecture sponsored by the International Union of Bricklayers and Allied Craftsmen and by AIA. The award and accompanying $5,000 prize are presented biennially to a practicing U.S. or Canadian architect or firm "whose projects spanning a period of time are deemed to reflect the ideals and design achievements of Louis Sullivan, father of modern architecture."

Kallmann McKinnell & Wood was founded in 1961 as Kallmann McKinnell & Knowles; that same year it won a national competition for the Boston City Hall and plaza. The jury cited the firm for 20 years of outstanding design work that "puts consistent emphasis on the expressive possibilities of structure and material."

The jury was chaired by Benjamin Thompson, FAIA, who won the Sullivan award in 1985. Other jury members were Peter Rose of Toronto; Cathy Jensen-Simon, FAIA, of San Francisco; B.M. Gonzales, FAIA, of Phoenix; Barbara Thornton; and architecture student Lisa Snow.

The jury also endorsed a special Sullivan award for Egyptian architect Hassan Fathy, Hon. FAIA, for a "career devoted to the development of design and building techniques involving indigenous materials, craft skills, and forms to enable poor peoples in the underdeveloped countries to be adequately housed."

Deaths
James Vincent Siena, Institute's General Counsel

James Vincent Siena, 55, who in September 1984 joined AIA headquarters staff as general counsel and group executive for government affairs, died Jan. 3. He helped develop and implement AIA's 1987 code of ethics and professional conduct and advised in the Institute's administrative and operating policies over the last three years. He also helped plan AIA reorganization and membership services.

"A dedicated servant to both the architectural profession and the public, Jim Siena was tireless in underscoring architects' obligations to their clients," said AIA President Ted Pappas, FAIA. "His sensitivity and concern for the public interest were everywhere evident as he guided AIA on major issues facing the profession."

Siena was a 1955 graduate of Case Western Reserve University and received his LL.M. in 1961 from Stanford University law school, where he was president of the Stanford Law Review. He served as counsel for the U.S. Office of Economic Opportunity during 1964 and 1965 as aide to Sargent Shriver in shaping the country's antipoverty progam.

As a former military officer, having served in the Marine Corps for three years before starting law school, he joined the Carter Administration as deputy assistant secretary of defense for European and NATO affairs. Prior to joining the AIA staff he was a partner in the Washington, D.C., firm of Davis Simpich & Siena.

AIA Executive Vice President Louis Marines called Siena's death "a profound loss to the Institute and the professions of law and architecture. ... He became recognized as [AIA's] senior statesman, whose wise counsel was always available to members and staff."

Siena underwent chemotherapy for cancer last year. His family suggests that any donations in his memory be made to the Mid-Atlantic Oncology Program in care of Georgetown University Hospital, Washington, D.C. □


MUNICIPAL HALL

There's little evidence this courthouse has been renovated. And custom Pella Windows are sworn to secrecy.

A passion for authenticity in restoration and renovation sometimes goes unnoticed. And nothing could make the architects of this municipal building renovation happier. They gleefully recall a local resident's comment: "I looked at the building and I don't see that you did anything. Why did they pay you to do nothing?"

Nothing, indeed. The historic 1914 Municipal Building in Sewickley, Pennsylvania, has been restored inside and out. Council chambers have been renovated, administrative offices expanded, a conference room added along with an elevator tower and a wing for fire department apparatus. The intent was to restore the existing building and have all additions match the original in kind, in both materials and design. It shows, or doesn't show, in everything from the original brass hardware to the red common brick of the new additions to the custom Pella Windows.

Custom Pella sizes and colors.

Custom Pella Windows were a vital part of the project. No other wood window manufacturer could provide the custom sizes and custom clad color the project required, with the quality the architects demanded.

Drafty, white double-hungs and basement windows were replaced with custom Pella Clad Double-Hung and Awning Windows. The architects "didn't want to look at the building and see a window and a window and a window" but rather intended the whole of the exterior to work together for a monolithic look. So Pella Clad Windows were specified in a custom tan enamel finish that matches the cleaned Cleveland limestone of the building's foundation.

Only Pella offers custom colors in aluminum cladding, adding just a week to normal delivery time. The baked enamel finish resists fading, chemical attack, chalking, chipping, peeling and cracking so the windows need no painting.

Inside, the natural wood beauty of Pella Windows complements the original oak woodwork, doors and molding which were carefully preserved.

The Pella Clad subframe system neatly covers the exterior of the old wood frame and allows for installation from indoors. Since no scaffolding or cranes were needed, the Sewickley Council of Garden Clubs could do the landscaping unimpeded.

Lower heating and cooling costs.

Some things, like the charming hose-drying tower, are used today as they were in horse-and-firewagon days, but many things needed a drastic update. The building's energy efficiency, for instance. Pella's Double Glazing Panel System was specified for all Pella Windows, giving nearly an inch of insulating air between panes. The perfect space for the removable wood muntins, safe from dust and damage.

Another of Pella's seven glazing and shading options, Type E Slimshade® blinds can be specified or retrofitted between the panes of the Double Glazing Panel System, where they help give Pella Windows a low U value of .23, actually outperforming triple glazing.

As for maintenance economies, Pella Double-Hung, Awning and Casement Windows pivot or rotate toward the center of the frame for easy cleaning from indoors.

Your Pella distributor can tell you more about it. For information, look for Pella in the Yellow Pages under "Windows." Call Sweet's BUYLINE or see Sweet's General Building File. Or send this coupon.

Please send me the latest literature on Pella for replacement and new construction.

Name ______________________

Firm ______________________

Address ______________________

City ______________________

State ______________ Zip __________

Telephone ______________________

This coupon answered in 24 hours.

Mail to: Pella Windows and Doors, Commercial Division, Dept. 00000, 100 Main Street, Pella, IA 50219. Also available throughout Canada.

Pella. The significant difference in windows.

Sewickley Municipal Building
Sewickley, Pennsylvania

Architects
Robert D. Graham, Sewickley, Pennsylvania
J. Ronald Reynolds, Coraopolis, Pennsylvania

Contractor
Coco Brothers, Inc.
Allison Park, Pennsylvania

Circle 48 on information card

Exit devices from the originators of the M.S.® Maximum Security Deadlock
US3 BRIGHT BRASS
US9 BRIGHT BRONZE
US10B OIL-RUBBED BRONZE
US 32 BRIGHT STAINLESS
UL LISTED
Adams Rite set the standard when they originated deadlock security hardware for narrow stile doors 30 years ago. Today they are raising the standard of exit devices. Now any building can have the complete exit device package from Adams Rite.
The new fire-rated Series 3000 complements the Adams Rite Series 8000 life safety exit hardware for wood, metal and glass doors.
All devices feature beautiful, full-width push bars with no-load actuation of only 8 lbs. anywhere along the bar. Each bar is either anodized or metal-clad in a wide choice of hardware finishes; brass, stainless and bronze. Whether you choose Rim, Mortise, Surface Vertical Rod, Concealed Vertical Rod or all four, you'll be choosing the brand name you can count on for legendary maximum security, and fast delivery, at a cost that won't alarm you.
Write or call for complete information and specifications.
ADAMS RITE MANUFACTURING CO.
4040 SOUTH CAPITOL AVENUE, POST OFFICE BOX 1301, CITY OF INDUSTRY, CALIFORNIA 91749
213/699-0511 TELEX: 3710777 CABLE: MS LOCK FAX: 213/699-5094

Alexander's Alternative for Creating an Urban Context

A New Theory of Urban Design. Christopher Alexander. (Oxford University Press, $39.95.)

This small book focuses almost entirely on issues relating to the process of designing areas of cities. Part of the reason this treatment is convincing is that it concerns the struggle to achieve wholeness. One of the most urgent problems in the field of urban design in the United States is how to create the quality of scale of human activity and intimacy that is present in countless cities in Europe without the hundreds of years that were required to give them this character.

Writes the author, Christopher Alexander: "This feeling of 'organicness' is not a vague feeling of relationship with biological forms. It is not an analogy. It is, instead, an accurate vision of a specific structural quality which these old towns had . . . and have. Namely: Each of these towns grew as a whole, under its own laws of wholeness . . . and we can feel this wholeness, not only at the largest scale, but in every detail: in the restaurants, in the sidewalks, in the houses, shops, markets, roads, parks, gardens and walls."

The book is devoted to the task of trying to articulate principles for recapturing this wholeness within the context of contemporary cities. It suggests a process for solving urban design problems using what I would classify as a "morphogenetic" approach. While the process begins with certain principles—a series of seven rules—the way they are applied in time has the character of rules of Japanese flower arranging. The process unfolds in time; each step is a response to the series of steps that preceded it as well as a vision of the whole outcome. As it proceeds, the vision becomes more coherent and incorporates the inward directions that were suggested by prior phases.

The way the rules are structured ensures a balance between the formation of details and the formation of larger wholes. This is in contrast with rational building systems (like those of Mies van der Rohe and his followers) that attempt to define a single principle that generates both the parts and the totality.

The payoff Alexander promises from this approach is a principle of order that


© Brian Rose

'A constellation of images': New York's Battery Park City.

is not merely skin-deep—in the plan of a building or in the contrived orderliness of its arrangements. In his approch to urban design, the order can be felt in every doorway, every step, and every street because it is generated from a common deep feeling source, not from plans, maps, and schemes alone. Follow these rules and you will find yourself with pieces of the city that have the richness of lovely European cities.

Alexander's work remains idealistic and necessitates compromises with existing patterns of development. For instance, he offers an example of an urban development for 30 acres of San Francisco waterfront without a single building more than five stories. Advocating a return to the city as it was prior to the automobile and the high-speed elevator conflicts with most current land values and may cut into the credibility of some of Alexander's proposals. But many developers are finding a strong market for this type of environment. While it is not for everyone, many consumers are willing to locate away from the main centers of commerce (as in San Francisco's South of Market area).

All the rules come under the control of a single overriding rule: "Every increment of construction must be made in such a way as to heal the city." Or, put in other terms, "Every new act of construction has just one obligation: it must create a continuous structure of wholes around itself."

As a matter of design method, Alexander attempts to provide a procedure for ensuring against the voids and environmental discontinuities that have become so common to the urban landscape. He suggests an alternative to planning buildings without any means of linking the fate of a piece of property to its neighbors. In essence, he suggests a framework for urban design in which the development of a plan for a given site must be linked to the creation of other centers, larger and smaller, in its vicinity.

Present-day urban design is far advanced over the discipline as it existed in the 1960s, when large downtown areas were designed by a single architect as if they were simply a very large building. Current vogue is to assemble and control a large piece of land (such as Battery Park City in New York City, or Fan Pier or Rowes Wharf in Boston) and develop an urban design framework under the control of a single design firm. Such a plan embodies an understanding of traffic, parking, utilities, and other elements but does not produce building designs. Typically, the framework plan establishes the locations of various types of buildings (residential, commercial, entertainment, etc.), the massing and density of buildings, staging, and phasing. It then brings in other architects (and financial interests) to work on pieces of the site, usually with coordination by an urban designer.

Alexander's framework goes a step further. It suggests a procedure by which a common vision of the environment can be evolved through a series of incremental piecemeal acts rather than a single coordinated plan. In other words, in his approach the urban design guidance is supplied by the "rules" that govern the system and not by one urban designer's intuition.

The best current urban designs—for example, Battery Park City—represent a distillation of the experiences of urban designers Alexander Cooper, FAIA, and Stanton Eckstut. Battery Park City is a constellation of images of old New York City,

continued on page 37

Books *from page 35*
including granite details and parkway architecture dating back to Robert Moses's reign, that are responsible for its apparent success. The architectural execution of the project was given to a team of firms willing to coordinate their efforts. This approach works famously when the right talent can be brought to bear on the project, as was the case in New York City, and where funding is available to finance the process. By translating design principles into a set of rules, Alexander has made urban design potentially available to many communities that might not be able to afford or to find help.

Indeed, Alexander's rules may suggest an alternative to current notions of city planning and zoning that still emphasize the convenience of the real estate industry rather than the most beneficial outcome for the city.

In this time of urban fragmentation, Alexander offers an approach to healing the voids and weaving together diverse influences based on the potential for creating a shared vision. We might take hope in his dogged insistence on his own vision of an architecture that can have this healing effect.

This is not to plead for solving problems with architectural solutions, but rather to adopt the first maxim of the healer: "Do no harm."—George Rand

Professor Rand teaches at the graduate school of architecture and planning at the University of California, Los Angeles.

A History of Western Architecture. (David Watkin. Thomas & Hudson, $45.)

"The present book will try to be descriptive and avoid theorizing," the author informs us, I presume, to indicate that his review of 2,500 years of Western architecture will be objective. However, as his previous books and the preface to this one make clear, David Watkin is not the man to give us an almanac. He has a point of view and it will out. He dislikes everything related to the "modern movement" and views facts through that lens. Since he is anti-constructivist and anti-functionalist he sees architecture as facade.

Evidence of his bias abounds: the architecture closest to the modern in its technological daring, in its search for light and lightness, is compressed into 50 pages called "The Gothic Experiment" while 18th-century neoclassicism is given 70. One dim reproduction is shown of the most seminal building of the 19th century—the Crystal Palace; a double-page color spread shows the bedroom of the Empress Josephine.

Like most recent surveys of architecture, Watkin's empahsizes dates, places, and appearances, and, as he states, not theory. Nor are the other verities—climate, materials, technology, use—discussed as the form makers they are. Thus architecture is made merely a tourist attraction.

A History of Western Architecture reminds us again that the architectural vocabulary of ancient Greece and imperial Rome has had almost universal acceptance over some 500 years. So obvious is this that none ask what magic has been exerted on the Western psyche by those peculiar, abstract forms called "the Orders," with their arbitrary moldings, snail-shell volumes, and leaking baskets of acanthus leaves. I would think an architectural historian, especially a Briton who dotes on an architecture that belongs to the tradition, climate, and light of the Mediterranean, would tell us why his compatriots clung to the Gothic tradition long after it was given up on the continent. Was it because they were a practical people who preferred plans that suited need and topography rather than artificial symmetries—steep pitched roofs, wide bay windows, and ample chimneys seeming more reasonable than hole-punched walls, flat roofs, and ornaments lost in the rain and mist north of 50 degrees latitude?

I would have hoped that Watkin, with his understanding of his native land and his scholarly repute, could explain the later acceptance of a foreign, unsuitable way of building by an otherwise strong-willed ruling class who hated, or at least looked down on anything that was not English. Is it possible that the gentry didn't like England and that this exotic style was a surrogate for the kind of place they wished it were—that place "where the lemon tree blooms"? The place, in fact, where many retired to or went on holiday?

Was this also true of the northern French, the Flemish, and the Germans as well as all those people living as far away as Warsaw and St. Petersburg? Watkin does not tell us but he does show many photos of many buildings in many lands conjured up out of predictable or fantastic variations on pediment and colonnade, abacus and zoophorus.

Opening the book at random I find an enchanting view of an 18th-century pavilion built in Russia for Catherine the Great by the Scottish-born Cameron. Its heavily rusticated base rises two-thirds of the building's height and is topped by a light and elegant Ionic temple in painted wood. The picture is all so bright and summery; one thinks how such a building must shiver in the long winter of Tsarskoe Selo. Again turning at random, I see the utterly fantastic art nouveau facade of a Guimard house in Lille.

The book is full of such unusual photos, all witness to the discerning eye of the author, but as it happens in these panoramic surveys a single illustration is given where several are wanted. There are some plans of buildings but only a few sections, superb color photos of the mad baroque of Balthasar Neumann and Dominikus Zimmermann church interiors but, alas, nothing that relates them to building or site. So with the text: it is good but it rushes along, wanting to tell about every building, everywhere, rarely pausing to explain. This in the end is dull reading and not very educational. Wouldn't we learn more from a more thorough look at fewer things?

If 2,500 years of architecture are to be covered in a single volume and the result is not to be a picture book or travel guide, selectivity is essential and explanation, not merely description, the means.

—Percival Goodman, FAIA

Mr. Goodman, professor emeritus, graduate school of architecture and planning at Columbia University, is a prolific writer on art and architecture.

Helmut Jahn. Nory Miller. (Rizzoli, $45 hardcover, $29.95 paperback.)

As dashing cover model for *GQ* magazine and architect of glitzy new corporate headquarters in South Africa, Germany, and the U.S., Helmut Jahn, AIA, is the 1980s "starchitect" par excellence. The surprise is that this Rizzoli monograph didn't come earlier and that the text, by Nory Miller—who has followed Jahn's career from his early Chicago years when Miller was editor of *Inland Architect*—goes far beyond the merely descriptive captions that pass for commentary in most such books.

Miller examines the sources and development of the main themes in Jahn's work and doesn't duck criticism. In talking of the architect's historicism, for instance, she writes, "As in many contemporary historicist designs, attitude and training as well as budget made it necessary to approach history in a classics comics version—simplified, *sans gravitas,* and translated into common parlance." Because the past that Jahn quarries is "someone else's past" rather than anything personal to him, "the visions are no more full-bodied than an imagined future," Miller observes, adding that in his futurist buildings Jahn "emerges as a genuinely lyrical designer."

In sum, says Miller, Jahn's "felicitous hand, speed, and instinct for high impact design recommend him to the developers and corporations he calls 'the Medicis of this age.' At the same time that zest for the new discourages the longer, slower process of refining each concept and each form until it has the irrefutable presence that work by masters such as Mies has."

—Andrea Oppenheimer Dean

Dictionary of Ornament. Phillippa Lewis and Gillian Darley. (Pantheon Books, $29.95.)

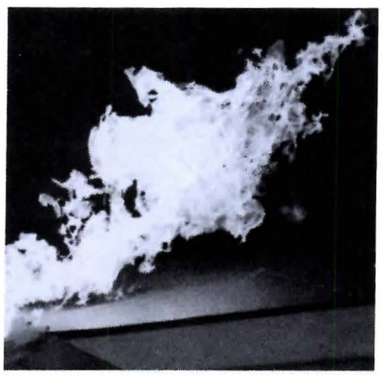
This dictionary describes ornament used by architects, designers, and craftsmen from the Middle Ages to the present. More than 1,000 illustrations complement the same number of entries. Subjects presented include: definitions and origins of motifs and patterns; themes of decoration, such as celebration of great events; techniques of ornamentation, such as rustication; and publications, such as pattern books. □

IT'S 1988
DO YOU KNOW WHICH CODES APPLY TO YOUR NEXT JOB?

3uilding codes and insurance 'equirements are getting ougher to understand.

pecifications are being written tighter than ever. Local ode approvals, insurance requirements and thermal erformance specs are all common in today's roofing rojects. Failure to comply can be costly for specifiers nd contractors.

Associated Foam Ianufacturers saw the end toward tighter code ompliance several years go and began a number f programs to meet ese always changing quirements. Because odes are written for omplete roof assemblies nd components, many



ombinations of materials have to be tested. At AFM, ttensive product and system testing and an ongoing, inependent third party quality control program have been tablished. AFM plants nationwide are familiar with the cal code and insurance requirements for roofing.

isulations that solve the codes.

erform® and Contour Taper Tile® EPS Roof isulations from AFM have been thoroughly sted by Underwriters Laboratories and eet the requirements of local building odes. When you specify EPS from a cal AFM plant, you can be sure it ill meet the job specifications and cal code requirements. EPS inilation contains no CFC's.

AFM testing includes...

- Flame spread and smoke developed characteristics, using ASTM E-84 and UL 723 surface burning test standards.
- Physical characteristics tests for typical properties of density, compression strength, thermal value, flexural strength, etc., found in the nationally recognized ASTM C-578-85 product standard.
- Roofing assembly testing for all the systems you use...single-ply, BUR, modified bitumen for combustible and non-combustible decks using ASTM E-108 and UL 790 test standards.
- A quality control and follow-up program conducted by an independent third party laboratory recognized by national and local code bodies.
- Product quality good enough to give the building owner a 20-Year Thermal Performance Warranty.

Insulation warranty increased to 20 years.

AFM's program of continuous independent testing and quality control certifies product quality before the EPS leaves the plant. That's why AFM Certified Quality EPS can be warranted to maintain 100% of the Industry Standard R value for a period of twenty years — the longest Thermal Performance Warranty in the roofing industry.

Write for your copy of the Warranty and for AFM's guide to insulation specifications.

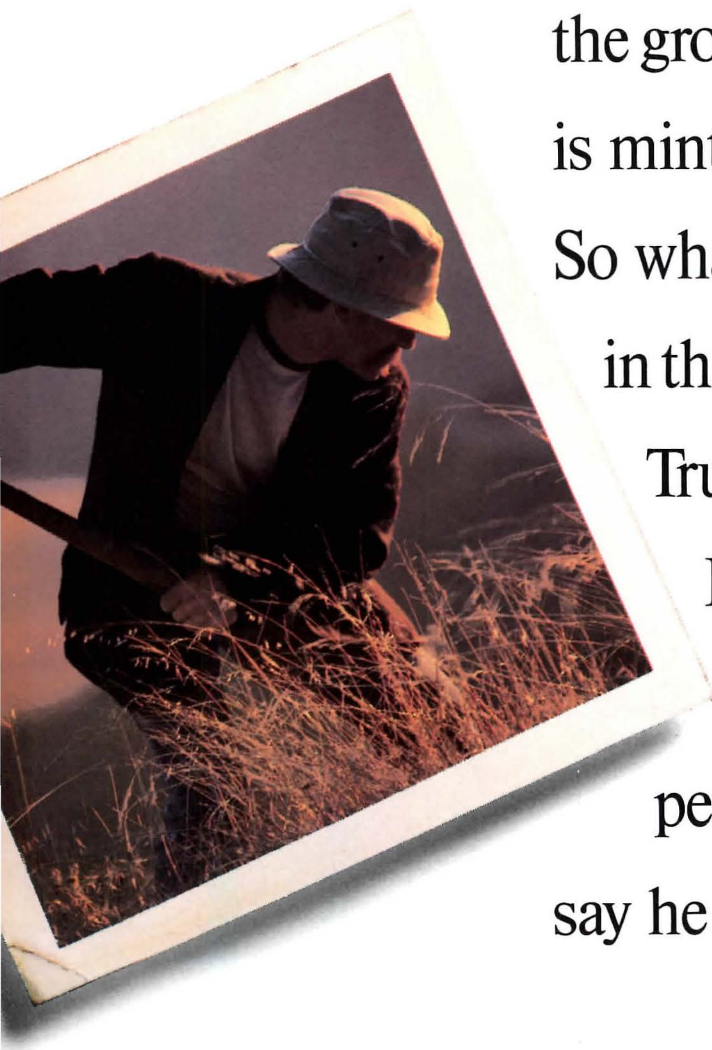
Associated Foam Manufacturers, Inc.
P.O. Box 246, Excelsior, MN 55331
Phone 612-474-0809
Call Toll Free 1-800-255-0176

Circle 56 on information card

Don Bauman. Loves to fish.

One spring day back in '69, right after he moves to the country, some 40 miles north of Grand Rapids, Michigan, he buys a two-drawer lateral filing cabinet at the company store. 800 series. Garden variety. Nothing special. Lugs it home, digs a big hole, sticks it in the ground. On its back. Fills it with potting soil, throws in some good 'crawlers, starts farming his own worms. Local trout go crazy for Bauman's worms. All his fishing buddies hate him.

A fish story.



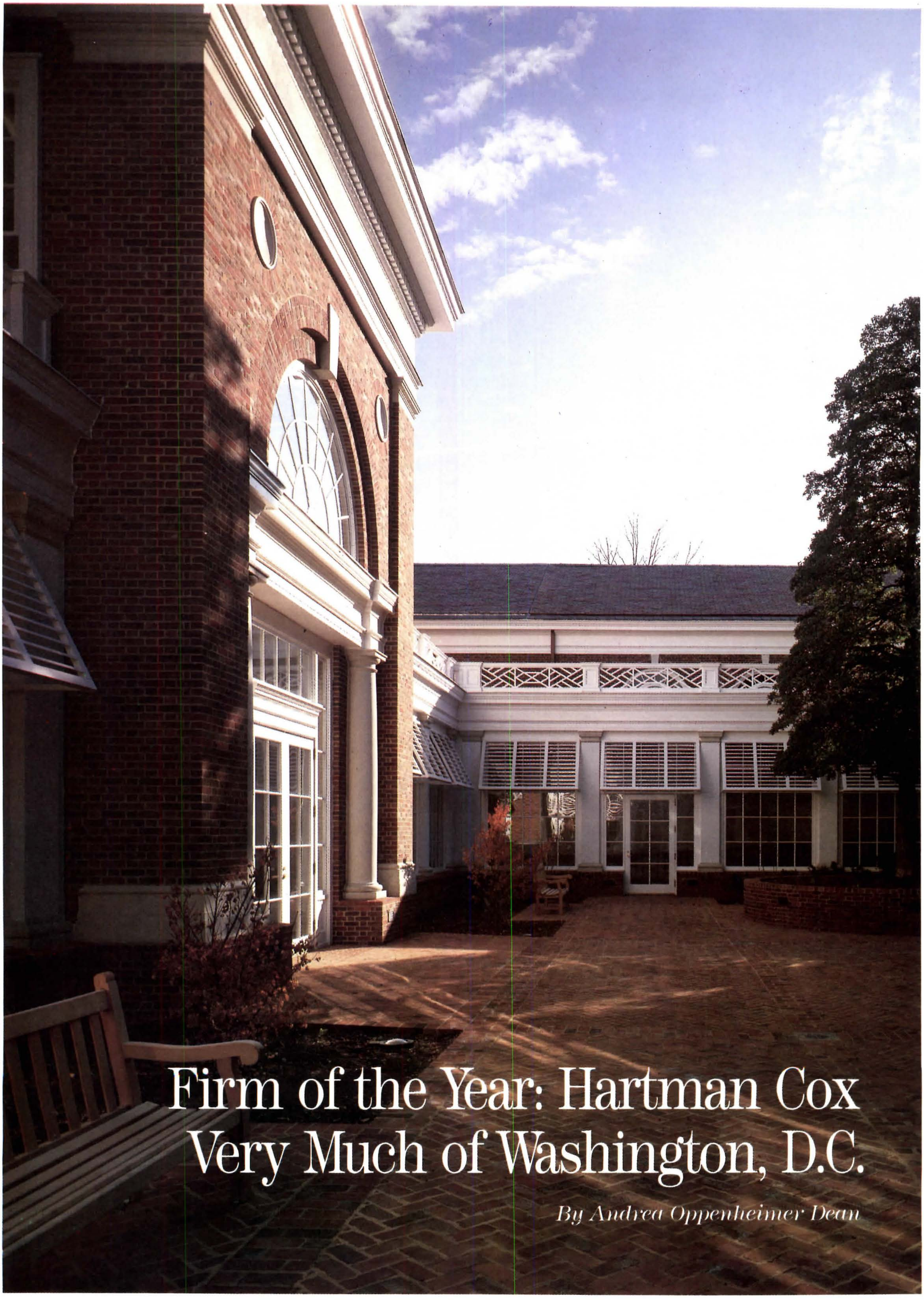
Eighteen years go by. The potting soil is water-logged. Bauman figures the file must be shot, too. Spends a Saturday morning digging it out of the ground, hosing it off. Darn thing is mint. Barely a spot of rust. So what does he do? Puts it back in the ground. Starts all over again. True story.

Know what he does for Steelcase? Evaluates competitive products...You might say he found his niche in life.

ARCHITECTURE

Much of this issue deals with one of our favorite subjects, context. On the following pages we profile the recipient of this year's AIA firm award, and we can't think of a firm that has consistently paid more serious attention to the subject. Then follows a series of articles on individual examples of college and university campus planning and design. No area of architectural activity commands more attention to context, for nearly every institution of higher learning has its beloved buildings and places that need to be respected as well as preserved. In a real sense articles about campuses are articles about urban design, for building them is very much like building cities, with one important difference: on the campus there is a single overall client, even though a variety of individuals and academic fiefdoms are involved. This should (but doesn't always) make possible an additional architectural coherence and the enforcement of additional attention to context.

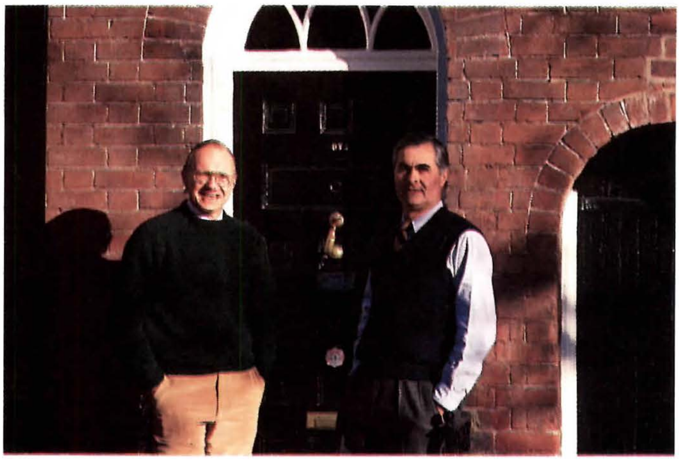
An announcement of a slight change in course: The June issue will focus on interiors, but not in the format of an awards program. We plan to go beyond presentation of individual works to more general articles on interior design. Individual works will be part of it, however, and submissions are welcome up to April 1.—*D.C.*



Firm of the Year: Hartman Cox Very Much of Washington, D.C.

By Andrea Oppenheimer Dean

© Robert Lautman



Allen Freeman

Based in Washington, D.C., Hartman Cox Architects has made its principal contributions in understated buildings that defer to the capital city's predominantly neoclassical and Beaux-Arts monumental core and to each building's immediate context. In their 22 years of partnership, and especially in recent years, George Hartman, FAIA, and Warren Cox, FAIA, have increasingly abandoned modern design devices to pursue an ever more literal historicism. Their approach to design is highly studious, intellectual, and labor intensive, and it is coupled with an unusual management style.

Though Hartman Cox's work has changed dramatically over time, it has never been trendy. No wit or whimsy here, no oversized keystones or other cartooned historical quotes. Their designs will never make the cover of *Time* magazine. For as Roger Kennedy, director of the Museum of American History, wrote in nominating Hartman Cox for the AIA firm award, "They do not show off; instead, they demonstrate a finely tuned sense of the relationship between continuity and creation." That doesn't make for stylish architecture.

In fact, the partners denigrate style, even personal expression, as a trap. Hartman explains, "You can't be unaware of what's happened to people who got caught in too rigid a situation. We saw one 1960s star lose his position as the most important architect in the country in less than two years because he was inflexible." Cox adds, "We're not interested in creating totally new imagery for traditional situations, but in bringing to them associational values and qualities specific to the building type."

The result is a highly flexible, pragmatic approach; Hartman Cox is a stylistic switch-hitter, changing the style to suit the situation. For example, the firm's 1980 addition to a rural northern Virginia Presbyterian church, which resembled a southern farmhouse, looks like a remodeled barn, while the recently completed St. Patrick's Epsicopal church in Washington is configured as a traditional, urban, high-church building. It is "romantic with broken massing and small scale on the exterior," as the partners describe it, is centered on a courtyard, and looks as though it's been there for 50 years.

In Cox's words, "The farther this stuff goes toward self-expression and artiness, the worse it gets. We don't see Pope and Cret being deliberately 'creative.' They were deliberately problem-solving professionals." That's a fair description also of Hartman Cox. Its work is thoughtful but not provoking, fresh but not impertinent. For, as Cox says, "We would rather have a very good practice for 30 or 40 years than be famous for 15 minutes." And though the firm has no identifiable style, its houses, churches, speculative office buildings, and institutional and public edifices *can* be recognized for the respect with which they approach their surroundings and for being consistently deft in plan, proportions, scale, and detailing.

Left, courtyard created by 1987 Monroe Hall addition at U. Va. Above, Hartman (left) and Cox in front of Georgetown office.

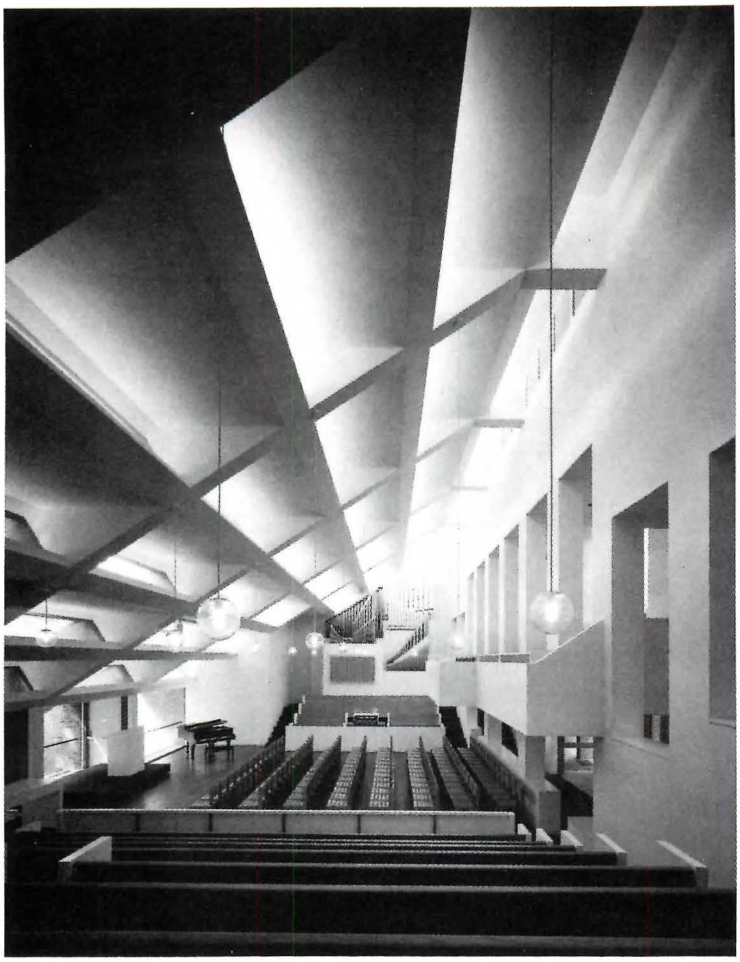
The firm's organization and management style is unusual in this age of managers and publicists. It fits the partners' pragmatic approach to design and their view of architecture as a master-of-all-trades profession. "The key to our success," says Cox, "is that we both combine a facility for the artistic *and* the practical." The firm has from 20 to 28 employees, all architects except for two secretaries. There is no business manager, no public relations person. "This eliminates a whole level of management, which from our point of view is unproductive," says Cox. "We can do the business stuff, very fast, together over lunch once a week or early in the morning."

Hartman adds, "We do no marketing, so we can spend that time that a normal firm dissipates—it's often partners' time—on the buildings. Also, we try to get good fees." The firm is normally hired on the basis of completed buildings and reputation, which, says Hartman, "are a result of devoting time, and you can't afford to sweat blood on design unless you can get decently paid for it."

Unlike most partners, Hartman and Cox attend all initial client interviews together and, if they are uncertain of the outcome, will ask for a follow-up meeting, virtually assuring the result. "The famous firms tend to send some kid down, and only once," explains Hartman. "So, when we show up together, twice even, we get the job." The firm pursues only half a dozen jobs a year and is hired for about five.

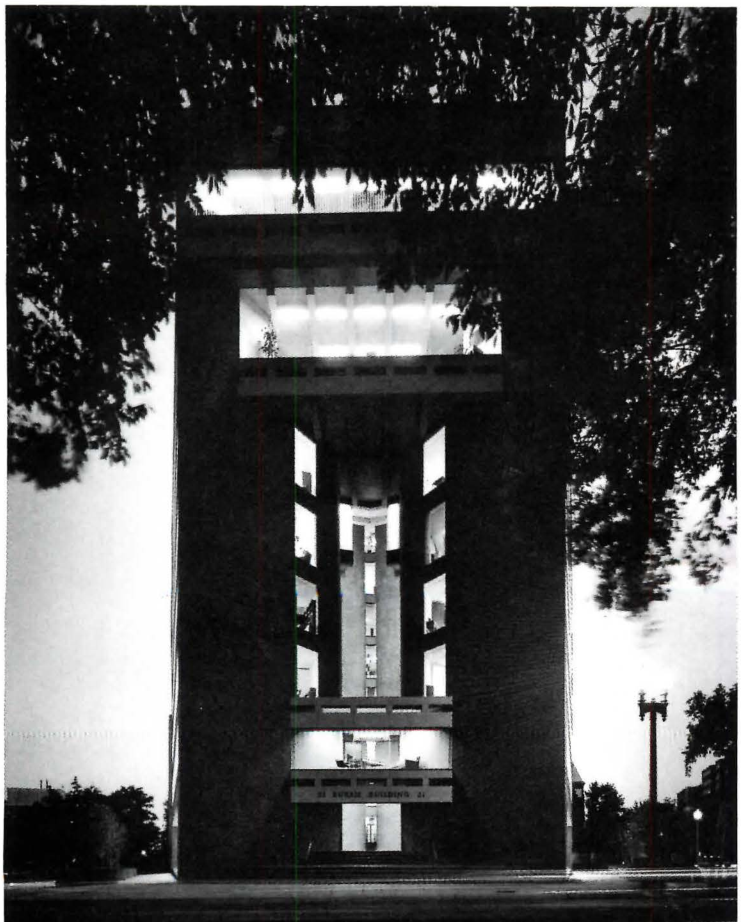
Nor, as is usual, is one partner the principal designer. Hartman and Cox prepare for client interviews together. "By the time we get there," says Hartman, "we've set the scheme, fixed the approach." They don't use computers for design, and, though a team headed by one partner carries each project to completion, it is virtually impossible to distinguish a job headed by Cox from one that bears Hartman's name. And increasingly, junior partner Mario Boiardi, AIA, senior associate Lee Becker, AIA, and architects Graham Davidson, AIA, and Stephen Vance, AIA—all of whom have been with the firm more than 10 years—are brought into the process at early stages to guide projects to completion.

Contrary to common practice, Hartman Cox does not separate design and production. "It leads to forcing the limits of technology instead of encouraging design changes and more thought," says Hartman. The partners are both tinkerers. "Warren has boats, we both mess with our houses and make furniture," explains Hartman, adding, "The business of fooling with

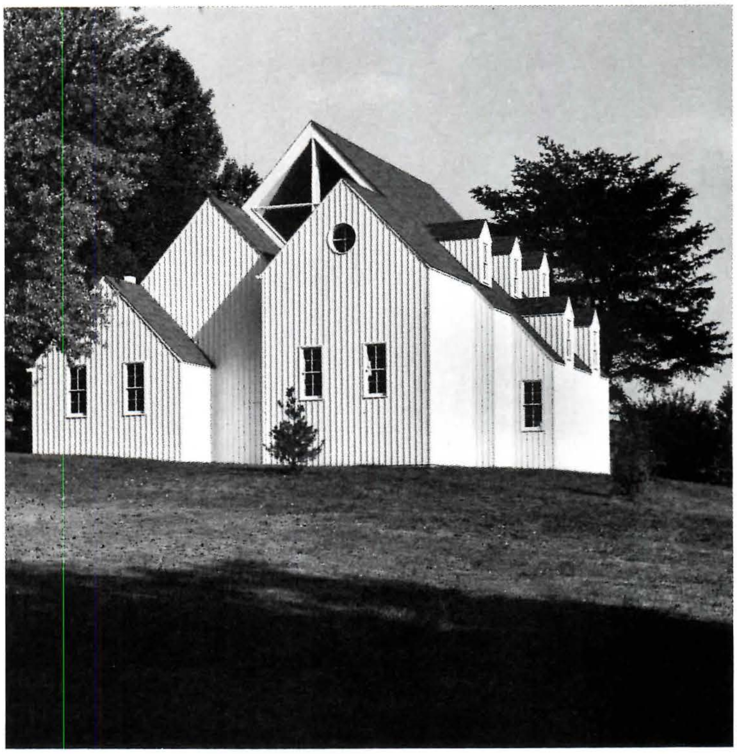


© Robert Lautman

Clockwise from above: chapel for Mount Vernon college, Washington, D.C. (1970); Immanuel Presbyterian church, McLean, Va. (1980); Foster house, McLean (1983); National Permanent building, Washington (1977); Euram building, Washington (1971). Facing page, National Humanities Center, Raleigh, N.C. (1978).



© Robert Lautman



© Robert Lautman

© Arnold Kramer

© Robert Lautman

stuff goes back to making models as kids. You learn how things go together, and, as with everything, the more you know about it, the more interesting it becomes."

They are also interested in history. Both have traveled extensively; both are widely read and mine their reading and travels for design work. "If we have to make an arcade, for example, we look for the nicest arcade we've ever seen and figure out how to do something like it," says Cox. Hartman adds, "We don't have too many preconceptions, which allows us to be appropriate."

If the firm has a drum to beat it is the idea that buildings should be appropriate and create a "sense of place." This preoccupation and the concomitant scepticism about modernism began in architecture school, if not earlier.

Cox grew up firmly rooted in Washington, D.C., and Kennebunkport, Me., where his family spent summers. Hartman, an Army brat, grew up here and there. He went to Princeton—and speaks fondly of its "strong sense of identity as a place." Cox went to Yale, and both partners majored in art history as undergraduates ("which teaches you that there is no 'it' when it comes to style," says Hartman). Then each matriculated at his university in architecture. Princeton, then under the influence principally of Jean Labatut and Louis Kahn, took an inclusive approach, while Yale was dominated by "the Harvard GSD all-stars," as Cox refers to Paul Rudolph, Ulrich Franzen, Harry Cobb, Philip Johnson, "and the guys who were in *Record* every month."

Cox recalls, "They were beginning to teach the slam-bang solution, the heavy muscular stuff. You were so bombarded by these guys, each with his own little design mannerism and definite viewpoint, that you found yourself feeling you had to think they were all right or none of them was right. Almost everybody who went to Yale at the time ended up doing his own thing. At one point, Ernesto Rogers gave a lecture at Yale [he was also one of Hartman's teachers at Princeton]. Everything about his work fit together and was suited to the surroundings and the scale was nice. Rudolph asked me afterwards why the students liked the lecture so much. I told him, 'because what he said was true.'" Cox subsequently spent two summers in Italy with Rogers's BBPR; years later, Hartman would spend six months, in 1977-78, at the American Academy in Rome studying the contextual relationships that define Rome's architectural identity.

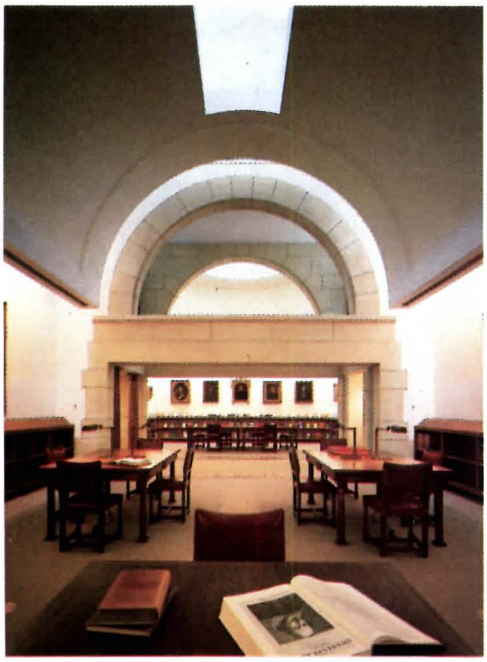
After graduation from Yale and a short stint as technical editor at *Architectural Forum*, Cox went home to Washington and accepted a job at the city's then-strongest design firm, Keyes, Lethbridge & Condon, where Hartman too had landed. In 1964, Hartman started his own firm where Cox joined him a year later. By one of many fortunate coincidences that have benefited the partnership over the years, the firm was born just as a building boom lasting almost two decades got under way in Washington.

Until 1980, Hartman Cox's work remained modern in feeling and style, though it echoed nearby architectural elements before it became popular to do so. For example, the firm's first commission, the Phillips-Brewer house of 1968, just outside Washington, is white-house-modern, but its shingled roofs, white exterior walls, and angled intersections take cues from neighboring, traditional houses.

The partners' first large building was a 1970 chapel for the neocolonial, red brick campus of Washington's Mount Vernon College. The chapel presents a modest, modern, brick face toward the campus while tumbling down its sloped site in a long, steep roof with inset windows admitting diffused natural light to a serene, Aalto-like sanctuary.

Hartman Cox's first of many office buildings in Washington, the Euram of 1971, though a brick and concrete minimal form, is configured for its site at a circle's edge and has a complex, angular atrium at its entry. Today, the partners criticize it as

© Robert Lautman

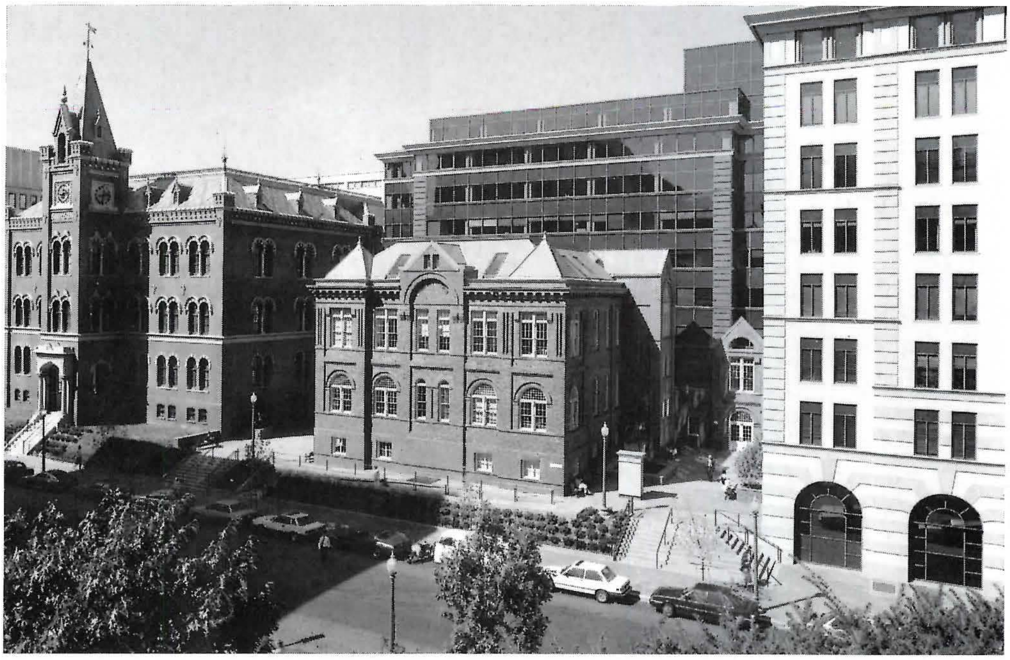


© Peter Aaron/ESTO

© Peter Aaron/ESTO

Swain Edens

Below left, U.S. Embassy office building, Kuala Lumpur, Malaysia (1983); below right, Sumner School complex, Washington, D.C. (1985). Facing page, clockwise from top, speculative office building at 4250 Connecticut Ave. N.W., Washington (1983); courtyard of embassy at Kuala Lumpur; headquarters for the H.E. Butt Grocery Co. chain, a complex of six buildings—two restored, two extensively altered and adapted, one renovated, and one entirely new, San Antonio (1985); and reading rooms in an addition to the Folger Shakespeare Library, Washington (1983).



© Peter Aaron/ESTO

the work of young architects, saved from calamity by Washington's 12-story height limit. Cox explains, "If it had been bigger it would have been a nightmare, because it's strong and abstract and scaleless and blank. A bad small building is nowhere near as bad as a bad big building."

It was followed by the National Permanent Bank of 1977, whose principal exterior feature is rounded, concrete ducts that act as columns and were intended to echo those on the nearby Old Executive Office Building. For the New York *Times,* it put contemporary Washington on the map architecturally. "It proves that it is possible to design a building in downtown Washington that is not a pretentious box but is not boring, either," wrote Paul Goldberger.

In 1978, the firm completed its last thoroughly modern-style building, the National Humanities Center between Raleigh and Durham, N.C. The AIA Journal called it "a monastic retreat for secular scholarship." Noting "the crystalline logic of its conception," Nory Miller wrote, "what contributes most to the mood are the qualities of the space and light. . . . The light is quiet—fresh and crisp and so evenly dispersed that it seems to give the air presence."

Despite its clean modern look, the scheme for the Humanities Center, says Hartman, "is very closely related to the first campus in America. It's got wings and a central hall like the University of Virginia and a system of streets along which buildings are placed—brick-paved, skylighted interior streets."

Hartman Cox's work since the Humanities Center has been increasingly regionalist and revivalist. Nineteen eighty saw completion of the aforementioned Immanuel Presbyterian church, modeled on nearby rural, vernacular buildings of northern Virginia. Three years later came an art deco-influenced, speculative office building echoing neighboring moderne forebears on Washington's Connecticut Avenue. Then came the 1983 addition to the Folger Shakespeare Library, which appends to the rear of Cret's original building a stripped, neoclassical structure that houses a vaulted, top-lighted, new reading room. Nineteen eighty-five saw completion of the Sumner School complex, comprising a small cityscape that combines restoration, an addition to Adolph Cluss's Sumner School of 1872—which is all but indistinguishable from the original—adaptive reuse of another school on the site, and a new, modern, background office building.

In the mid-'80s, Hartman Cox took initial steps beyond the geographical confines of Washington, D.C. In 1983, the partners completed the U.S. Embassy at Kuala Lumpur, Malaysia, with obvious relationships to Malaysian vernacular architecture. Two years later, they finished the partly old, partly new, H. E. Butt Grocery Co. headquarters in San Antonio, recalling typically Southwestern architecture rooted in Spanish colonial forms.

Last year, Hartman Cox completed Gallery Row in downtown Washington—the restoration of five small buildings and the addition of a grand stair that links first-floor art galleries and offices above them. In addition, they finished two other Washington buildings that mark a new direction for the firm, one of more literal revival.

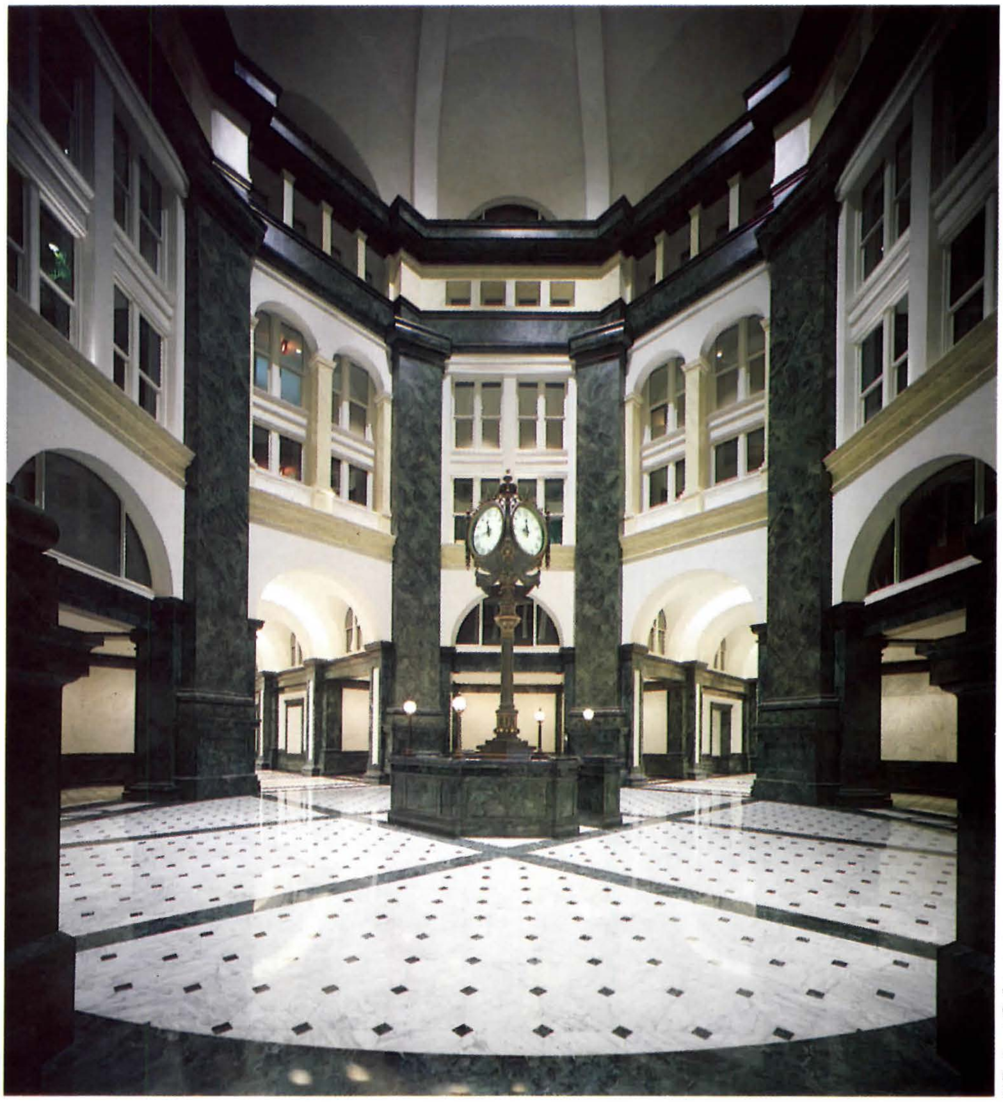
The first is a 12-story office building at 1001 Pennsylvania Avenue; the second is the already mentioned St. Patrick's church. Occupying a full block opposite the Federal Triangle, "Ten-Oh-One Pennsylvania," as it is called, faces the triangle with a neoclassical facade, while its side street elevations stitch together restored old buildings that were on the site and are now embedded in the new building.

The old-looking St. Patrick's church, ironically, meets an adjacent, boxy, 1960s school in the same way that 1960s buildings typically related to their predecessors—with disregard. The result, as in the '60s, is a blank box that looks haphazardly appended to an interestingly massed and detailed neighbor. Cox explains, "There comes a point, when you're dealing with

© Robert C. Lautman

© Peter Aaron/ESTO

Facing page, top, three photos showing all four sides of office block at 1001 Pennsylvania Ave. N.W., Washington, D.C. (1986). This page, ground level interior views of that building. Facing page, below, another Washington building, Gallery Row (1987), combines restoration and infill; skylighted stairway spirals behind glassy facade above entrance.



© Robert C. Lautman

bad buildings that you can't tear down, when even the most dedicated contextualist can't bring himself to be contextual." Hartman avers that in 10 years people will think the box is the addition, the church the original.

Hartman Cox's most recent project, an addition to Monroe Hall at the University of Virginia in Charlottesville (see also page 56), appears at first glance to replicate nearby neoclassicist buildings and meets the original so seamlessly that it's hard to tell where the new begins and the old leaves off. Closer inspection shows Monroe's architectural elements to be both tougher and less stocky than those of its neighbors, evidence that the architects have enlisted additional sources as models, specifically Britain's Belsay Hall of 1806-17 in North Bumberland. Through its siting, Monroe Hall carves out a new quadrangle. The building itself is configured around a central courtyard from which light pours in through oversized windows, and, though designed from the outside in, the building is planned, à la modernism, to make every square foot of space usable.

An obvious question, at this point, is what happened between the modern Euram building of 1971 and the neocolonial Monroe Hall of 1987? The way Hartman and Cox tell it, their development was an almost inevitable consequence of working and living in Washington at a time of worldwide reaction against modernism, which sanctioned an attitude of "anything goes," as Philip Johnson described it.

By the late '70s, the partners were weary of the "continuous chaotic change fostered by modernism," as Cox puts it. "God didn't give us modern architecture," he says, "to do it forever." Attitudes toward the city, toward history, and toward preservation had changed. At the same time, because Hartman Cox began getting commissions for semipublic buildings and therefore studying their prototypes, the partners found themselves looking at "this great stash of really terrific neoclassical, Beaux-Arts Washington buildings dating from about 1895 to the Federal Triangle of the 1930s," recalls Cox. "And we ended up *just liking the old ones better.* They're richer, handsomer, more functional. They're just damned well better." Hartman adds, "They are more thoughtfully done, more studied, better scaled, have better detailing and finishes."

A major influence has been both partners' service on the review boards whose approval is needed for every new building in downtown Washington. "One of the reasons we've been successful," says Hartman, "is that we work both sides of the street, and you have to be here to do that. On the review boards, you begin to understand that the L'Enfant plan is more valuable than any single building, and that some buildings and some squares are more important than others. People scream and yell that the boards take the middle-of-the-road solution, but in terms of building a city—not a pile of idiosyncratic monuments—that's a pretty mature way to do things. Cities consist not of great spectacular buildings, but of really good, appropriate ones," says Hartman.

Cox, in turn, points out that with its low buildings, broad avenues, and hierarchies, Washington is a "city that doesn't respond well to signature buildings, and local architects have traditionally done better than outsiders in dealing with its problems." He notes, for instance, that SOM/Washington turned eclectic independently of, and long before, the firm's other offices and that its chief designer, David Childs, FAIA, served not only on review boards but also on the board of the Pennsylvania Avenue Development Corp. before leaving Washington to head SOM's New York office.

A second question springs to mind. Isn't this neoclassical revival stuff reactionary? In answer, Hartman and Cox point out that, while neoclassicism may be associated with authoritarianism elsewhere, in the United States it was the chosen style of democratic government. They also note that even such neo-Corbusians as Richard Meier are eclectic, having elected to

© Harlan Hanbright

© Harlan Hanbright

© Harlan Hanbright

© Rosanna G. Liebman

Two recently completed buildings that look as though they have been standing at least a half-century. On facing page, St. Patrick's Episcopal church (1986), located in a mostly residential neighborhood of Washington, D.C. Right, a neocolonial addition to Monroe Hall at the McIntire School of Commerce, University of Virginia (also shown on page 56).

ally themselves and tinker with a vocabulary from history, albeit recent history. As Stanley Tigerman, FAIA, wrote in a recent article addressing this issue, "A society based on hope originates. A society based on despair reiterates."

Wolf von Eckardt, who reviewed Washington architecture for many years for the Washington *Post* before joining *Time* magazine and then retiring from it, justifies Hartman Cox's eclectic buildings as "appropriate to their context and admirably modest. The buildings are hardly visible, which is exactly what's needed." Washington architect Hugh Jacobsen, FAIA, whose designs are generally modernist, doesn't consider Hartman Cox's work "copycat," as he puts it. "Their work has a quality of abstraction," he says, "that requires careful study, being well read. When you're infilling, it should be as though the original architect had become clairvoyant and understood today's problems."

Indeed, projects now under construction and on the boards show Hartman and Cox trying to place themselves in the shoes of clairvoyant, long-dead predecessors. Under construction is their law library for Georgetown University, an asymmetrical, neoclassical building focused on an entrance rotunda. An offspring of Schinkel's Reichsmuseum, it fills its oddly shaped downtown site and contrasts dramatically with a boxy, antiurbanistically sited Edward Durrell Stone building across the street.

With their project for a 29-story tower for downtown Baltimore, their first skyscraper, Hartman and Cox have taken another step away from the Washington geographic area. Modeled on 1920s setback buildings, theirs replaces the 1876 French-Romanesque Mercantile Building and, therefore, stirred up preservationist opposition. But, as the Baltimore *Sun* put it, Hartman Cox's "alluringly romantic image . . . was so beguiling that a good deal of the public opposition to the Mercantile displacement, especially from the local chapter of the American Institute of Architects, melted away after the plans were unveiled."

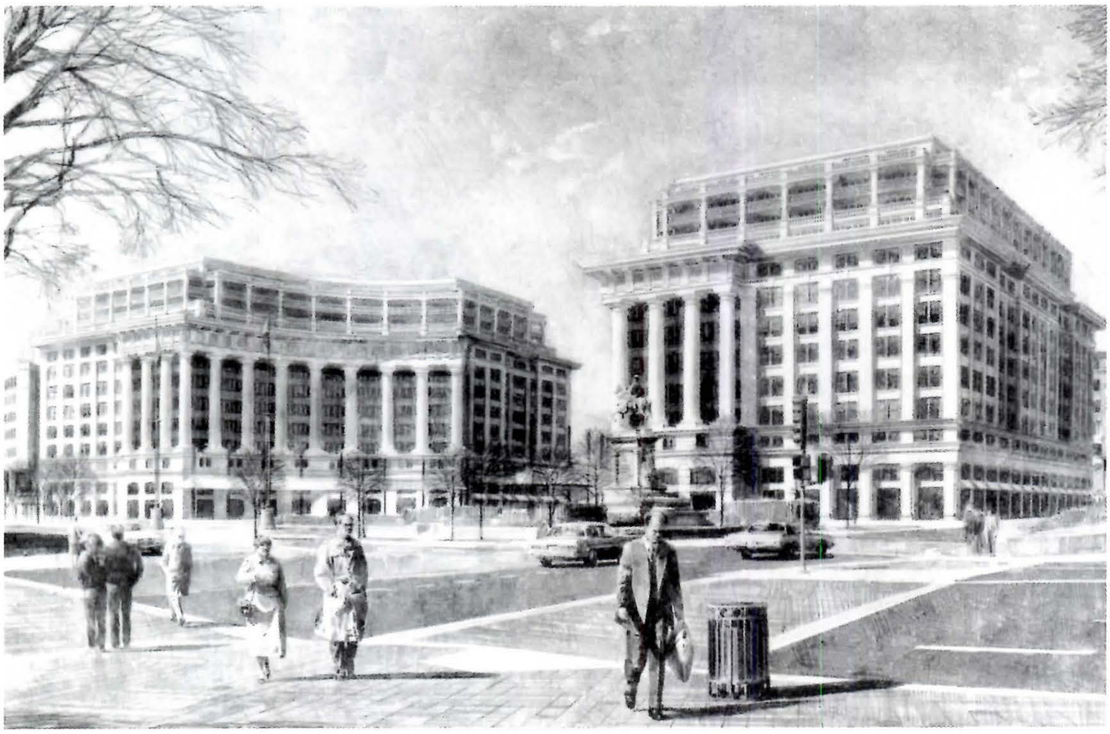
For their addition to Ernest Flagg's Corcoran Gallery of Art in Washington, the partners consciously "tried to figure out how Flagg would have done it," says Cox, "and we had the advantage of hindsight on the rejected Whitney and Guggenheim extension proposals, which tried to cram five gallons into a two-gallon pail. We were saved by the zoning regulations, to some extent, and were able to get the allowable bulk without going higher than the Corcoran." Hartman adds, "We looked back at those five studies Gunnar Asplund did before extending city hall in Stockholm. The first mimicked the existing building; the last, most modern one was built." Cox breaks in, "Our reaction was, 'he built the wrong scheme.' Asplund had as much talent in his little finger as we have in our two bodies, so we didn't see any reason to think we could pull off what he could not. I think what we did was the most responsible thing."

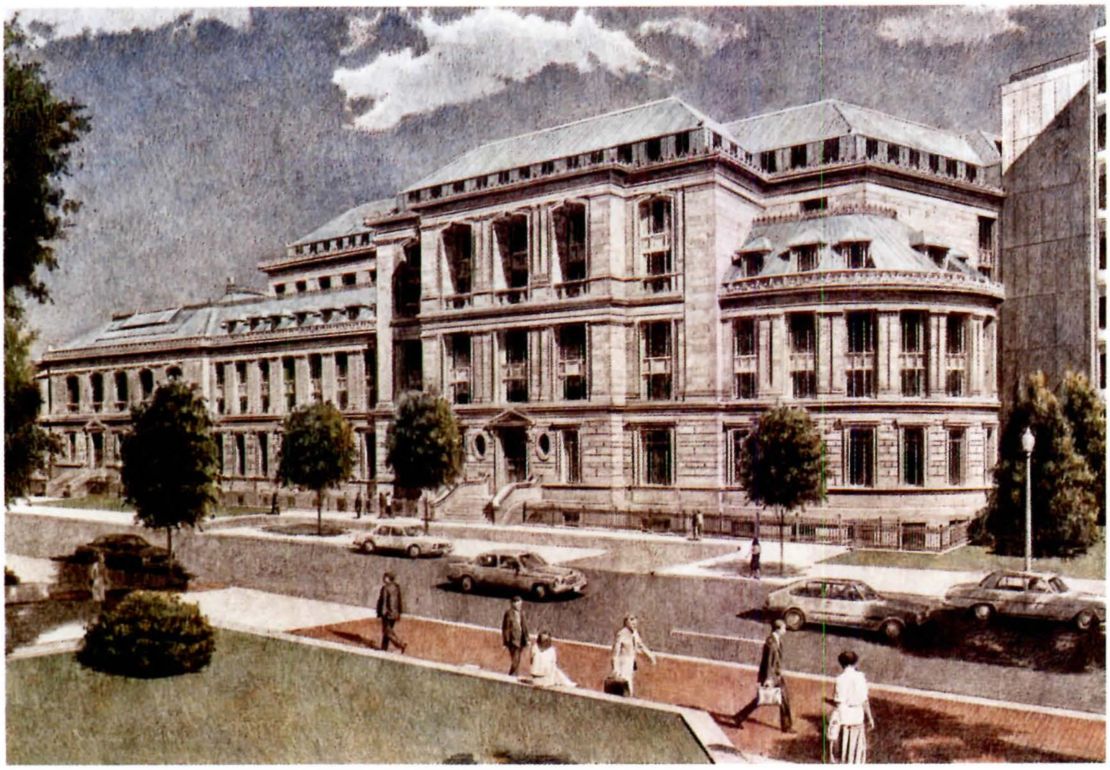
Hartman and Cox took a similar approach at their nouveau Beaux-Arts Market East project for downtown Washington. Comprising two curved buildings containing offices and housing above, its site plan was mandated by the Pennsylvania Avenue Development Corp. Where the buildings face the Federal Triangle they reflect monumental Washington, while their side street elevations, with unremarkable neighbors except for the obtuse FBI building on the west, say "offices," as Cox explains. He adds, "We hope it looks like an old Washington building."

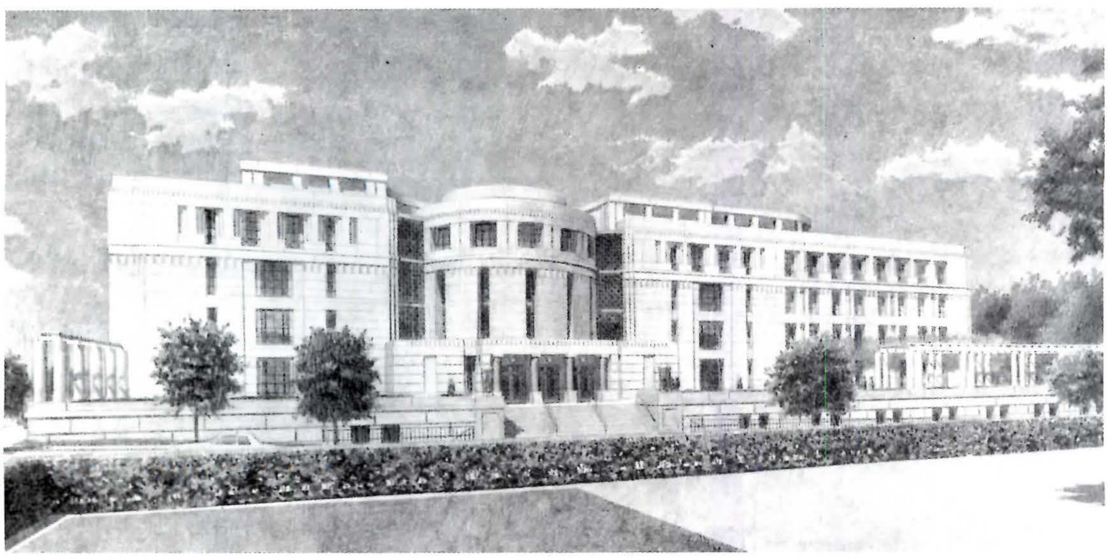
At that, Hartman heckles, "Warren, you're pushing the idea of a Washington school. Warren has us as direct descendants of Daniel Burnham."

Cox parries, "One would aspire to that. I'd rather be a forest than a lone tree. I'd rather be in the mainstream of Latrobe, Burnham, Cret, and those guys than with a bunch of people doing spec buildings at suburban Tysons Corner."

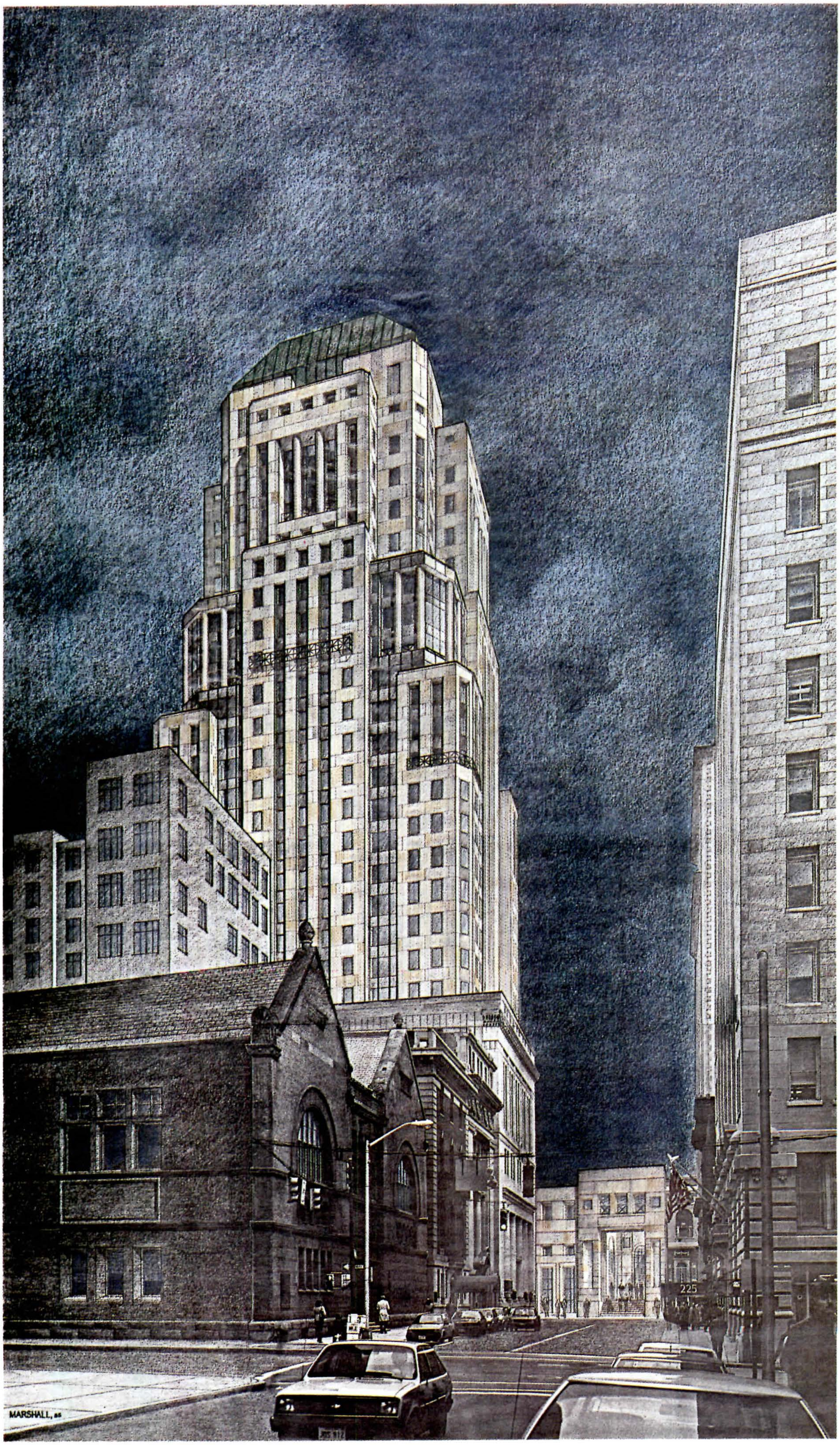
"Who wouldn't?" asks Hartman.

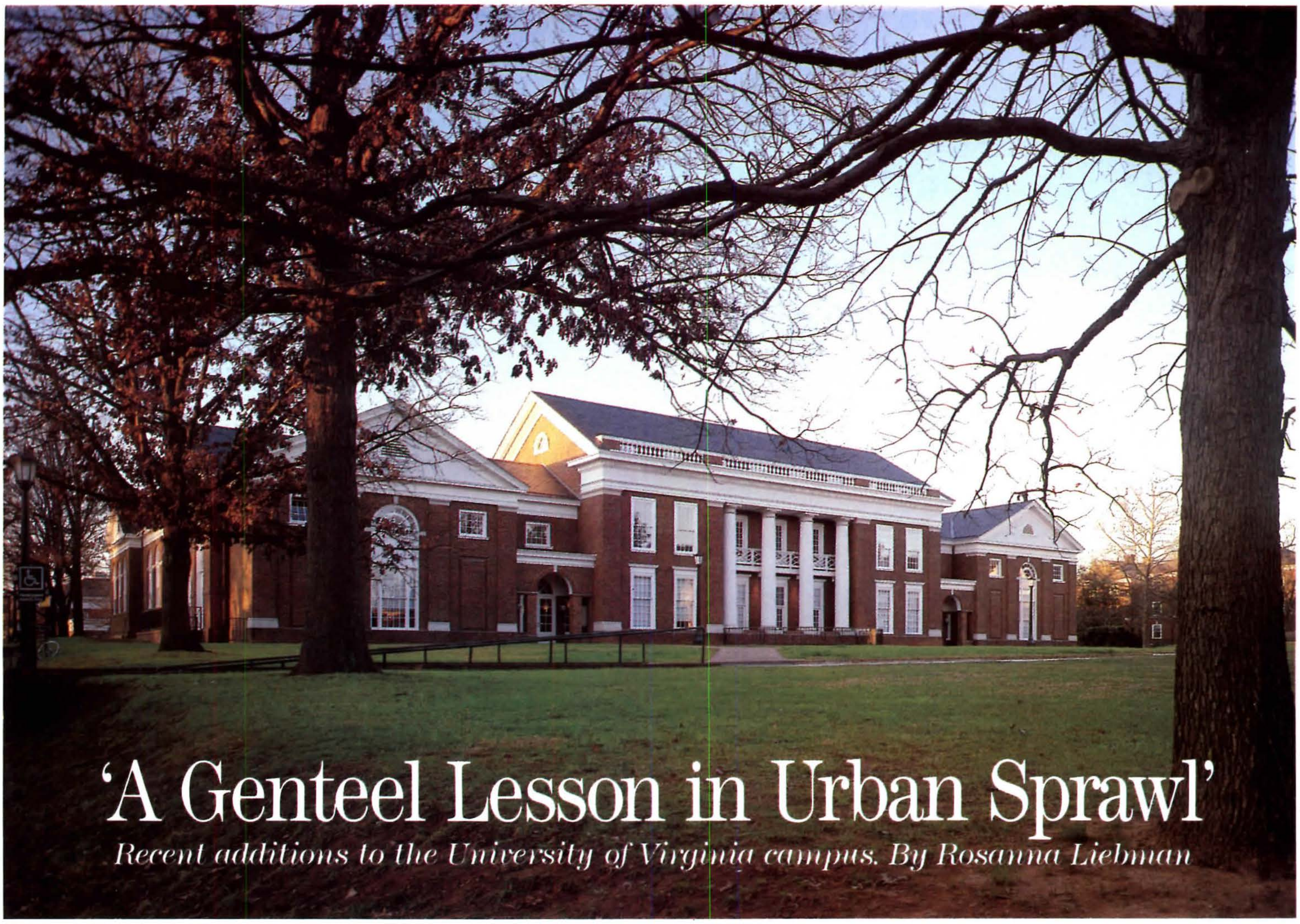






This page, three downtown Washington, D.C., projects: Top, Market East office buildings with residences on upper floors; center, addition to Corcoran Gallery of Art; bottom, Georgetown University Law School Library. Facing page, Commerce Place in Baltimore will be Hartman Cox's first high rise. □


MARSHALL, 86
225



'A Genteel Lesson in Urban Sprawl'

Recent additions to the University of Virginia campus. By Rosanna Liebman

Photographs © Robert Lautman

Thomas Jefferson was an architect not of monuments but of workshops. At the University of Virginia he introduced the concept that an institute of higher learning should take the form of an "academical village"—an expandable group of intimate pavilions rather than one inflexible monolith. He touted the educational value of diversity: the university's pavilions and rotunda were intended to introduce a sampling of classical architectural forms to students cordoned off in the New World. As a designer, Jefferson had his prejudices. The no-nonsense Tuscan order is the dominant style at the university; red brick, which was made from local clay, faces every building of his invention; and siting buildings in concert with nature was a high priority.

Today the University of Virginia is a genteel lesson in urban sprawl. Red brick buildings with white trim grow ever larger than the 10 pavilions that dot the lawn as they march through the hills and valleys and into the town of Charlottesville. But Jefferson's precepts, including the unwritten dictum for red brick, hold silent sway for architects who rise to the challenge of designing in and around his academical village.

In these pages (Dec. '85, page 72) Carleton Knight III took the reader on an architectural tour of the University of Virginia from the classicizing of Stanford White and Fiske Kimball through the brutalism of the 1960s and '70s to the postmodern '80s. During the last two years, in answer to demand for additional classroom space and support facilities, four new buildings have found a niche in this semi-urban complex. Except for one iconoclast, the concept underlying each of these buildings remains faithful to the spirit of Jefferson.

The addition to Monroe Hall is so contextual as to be indistinguishable from what remains of the 1929 original. The home of the commerce school, Monroe Hall is situated across from Jefferson's lawn on McCormick Road, the main thoroughfare through the university's central grounds. For years expansion had been curtailed because of strong opposition to building on this site—everyone feared an eyesore—and concern about raising enough funds to pay for a building that would prove the doomsayers wrong. But in 1982 the commerce school, forced to relocate a large portion of classrooms and faculty outside Monroe Hall (some faculty had offices in trailers placed next to the building), opted to expand its home base. Eventually the architecture firm Hartman Cox of Washington, D.C., was chosen for the job because of its reputation for context-sensitive architecture (see page 44).

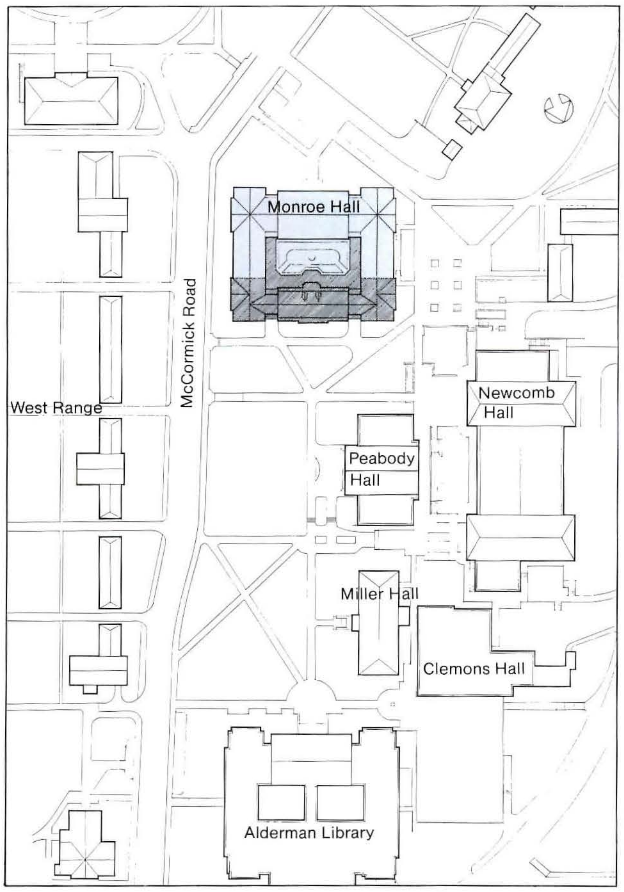
The original Monroe Hall was U-shaped with an arcaded screen on the north facade that masked an internal courtyard. Because of its siting on the edge of a hill, the building could expand only northward into the domain of stately administrative buildings and the main library. Traditionalists were not overly sentimental about losing the arcaded screen, which was dedicated to a "Virginian who served his native state in the Civil War" but who was never enrolled at the university. The architects had their own reasons for doing away with the arcade: it was a weak counterpoint to the facing library's monumental columns, it competed with the superior arcade that borders Jefferson's west range across the road, and it was too expensive to underpin during excavation. The courtyard, however, site of Friday afternoon happy hours until Virginia raised the drinking age, was retained.

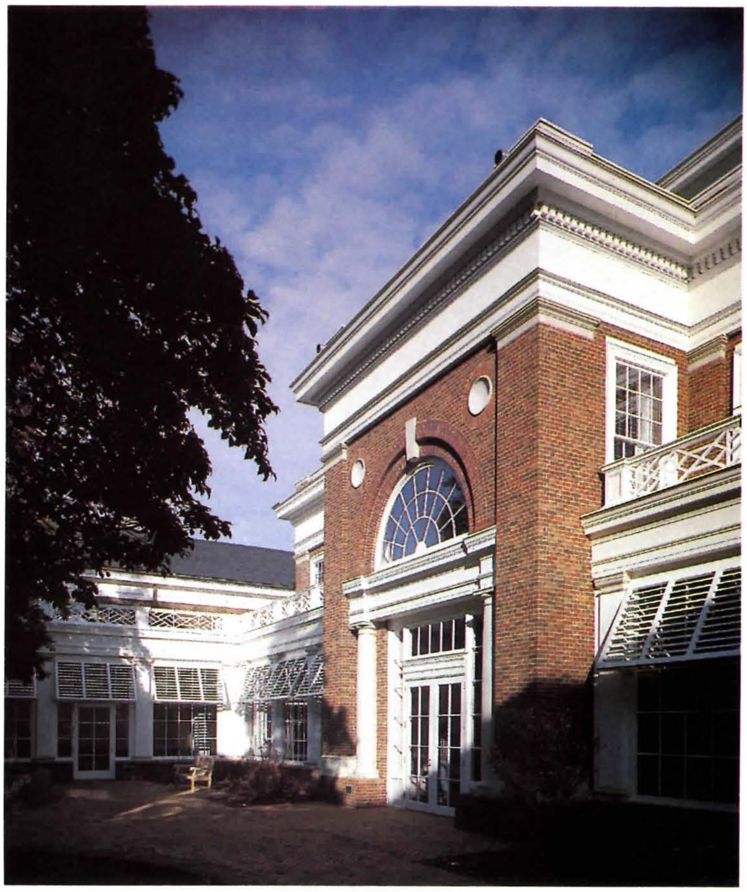
The addition transforms the footprint into a rectangular doughnut. Thirty-four thousand square feet of new space houses faculty offices, classrooms, conference space, and a sunny corridor punctuated by archways, which wraps 200 feet around the courtyard connecting the new and old wings. Teak lawn furniture and window seats give the students plenty of places to hang out between classes. These benches, though slightly awkward indoors, are the same benches that dot Jefferson's gardens, and they symbolize Hartman Cox's respect for and deference to tradition. This

---

Ms. Liebman is an architectural writer and photographer based in New York City.

On these pages, Monroe Hall addition by Hartman Cox. Left, the new north front, which encloses the shallow 'U' of the original 1929 building (site plan below). Below right, the courtyard side of the addition; bottom, ground-level, courtyard-facing passageway.





Photographs © Cervin Robinson

is seen also in the courtyard's Chinese-Chippendale railings derived from Jefferson via Peabody Hall next door. Meade Palmer, a landscape architect from Warrenton, Va., helped choose the plantings (including azalea, magnolia, and dogwood) based on scent, color, and tradition. On the east elevation the addition continues the form and proportion of the original building down to the 12-over-12 windows, which make for grander public rooms on the ground floor and more intimate offices above, each blessed by an operable lunette window. As for the much-feared north elevation, the proportions of Hartman Cox's original scheme were retained, but by popular demand a busy Georgian style was replaced with Jeffersonian Tuscan. Monumental columns balance those of Alderman opposite, and the arched entryway refers to the arcades on the west range. The building looks as if it had been there all along.

The architects studied various classroom types before deciding on one that would meet all the teaching idiosyncrasies of the faculty. A concentric, stepped-up, U-shaped seating plan allows for maximum seating and good sight lines. The study of commerce requires little in the way of specialized equipment. In fact, the whole show happens at the front of the classroom on the blackboard (here stretching the length of the wall as the professor works out an idea from left to right) or on a screen (mounted here on a ceiling track so it can be pushed out of the way). The only state-of-the-art pieces of equipment are ceiling-hung projectors that interface with computers so that a spread sheet, for example, can be displayed and modified by the class.

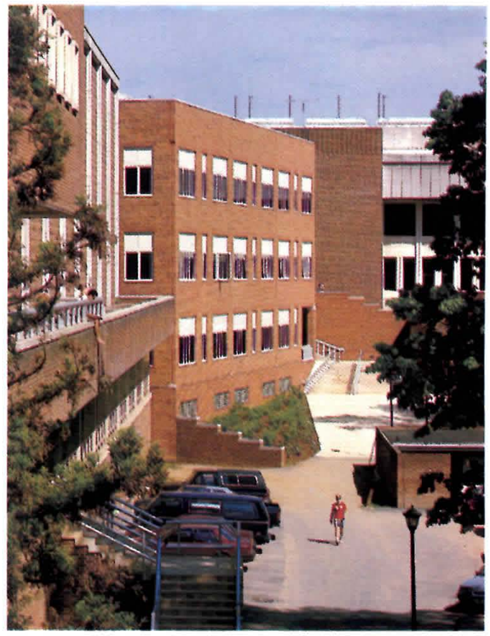
Technology reigns farther down McCormick Road in the new life sciences building designed by architects R.M. Kliment & Frances Halsband with engineers Wank Adams Slavin Associates, both firms from New York City. This building, too, is an addition, but one that intelligently distinguishes itself from the adjacent 1960s Gilmer Hall, which needed room to expand its biology and psychology facilities. While much of the interior space is turned inward, given over to highly advanced research laboratories, the exterior addresses each of the buildings in the immediate vicinity and makes a strong esthetic statement. Is the bold, arc-shaped facade a commentary on Jefferson's revered rotunda? Not according to Robert Kliment, FAIA, who explains how a drum with markers of differing intensities allows more than one orientation on its perimeter. The site for the Gilmer Hall addition begged for two main facades; the building faces a strong axis created by the 1950s Eggars & Higgins dormitories across the road, and what architect could ignore that vista? A flat limestone figure barely protruding from the drum marks that facade. Programmatically, the entrance wanted to face east toward the main campus to capture the traffic flow and take advantage of the plaza of the neighboring chemistry building, where there already was a gathering place for students. Here the limestone figure protrudes farther and transforms into an entry tower.

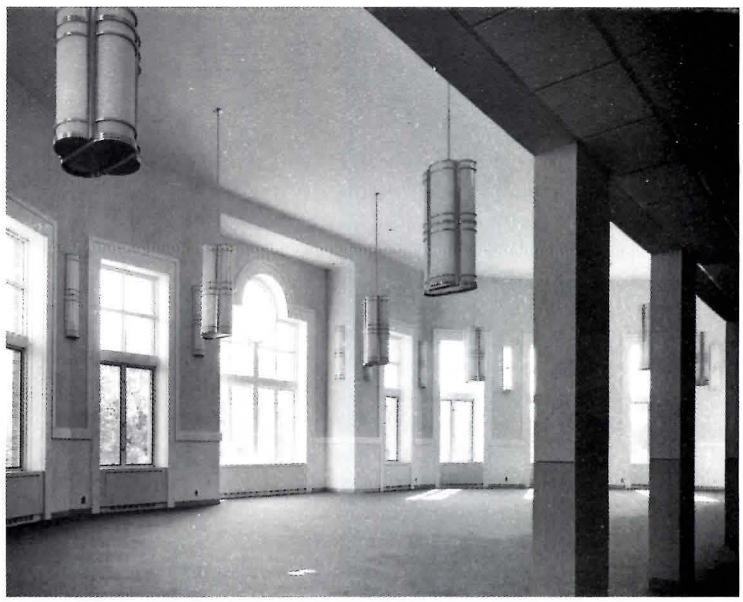
Most of the buildings on this midsection of McCormick Road were done in the 1950s and '60s, when contextualism was not a high priority for the university architectural selection committee. Still, in choosing their site orientation and materials Kliment and Halsband showed a great sensitivity to even this less than optimum context. Just as the rounded form mediates two elevations and respectfully nods to its neighbors, the color (brick, of course) tries to strike a compromise with the three buildings (of disparate shades of brick) among which the addition is wedged.

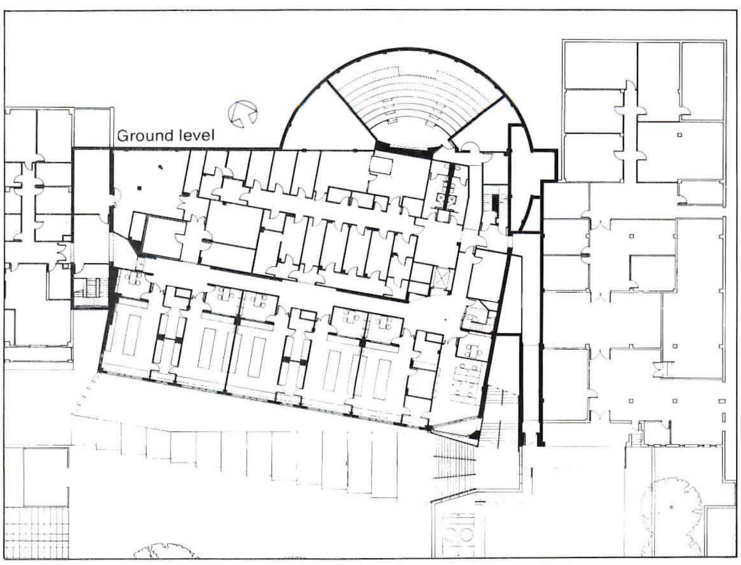
The unambiguous entrance tower marks the transition between semicircular and rectangular elements. Flexible modular spaces for classrooms and laboratories occupy the latter, which is deliberately angled to deflect the long, straight mass of Gilmer Hall. This block grows to three stories as it steps down a steep slope and practically abuts a nature preserve with groves of trees and a stream to which the architects added some new plantings, otherwise disturbing as little as possible. The new building's south facade is straightforward and discreetly upstages the ordinary chemistry and psychology buildings that bound it. On this facade, old and new Gilmer Halls are clearly separated by a rift (unlike the setback seam on the front, which was meant to be as unobtrusive and deadpan as possible—this is aided by judiciously placed trees). An "eroded" freestanding column on the southeast corner calls attention to a splayed staircase with jazzy railings. Heavy pedestrian traffic from athletic facilities and dormitories south of the site is swept up this stair and discharged onto the plaza and then eastward to the academic core.

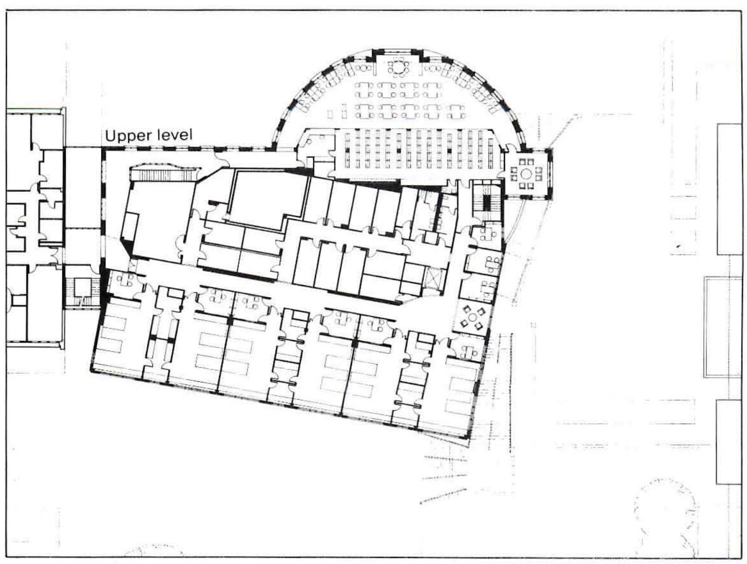
In form and color the life sciences building does end up recalling Jefferson's rotunda—a happy by-product of formal and programmatic investigation. And, in accordance with the unwitting model, the semicircular element (which is only 50 feet at its deepest—the building is not a drum at all) houses a library and

Kliment & Halsband's addition to Gilmer Hall suggests Jefferson's Rotunda. Facing page, window creates axis with dorms across street; below left, entrance is 90 degrees around drum. Below right, addition's back side angles from parent building (left in photo). Lecture hall, lower left, is below curved room, lower right.

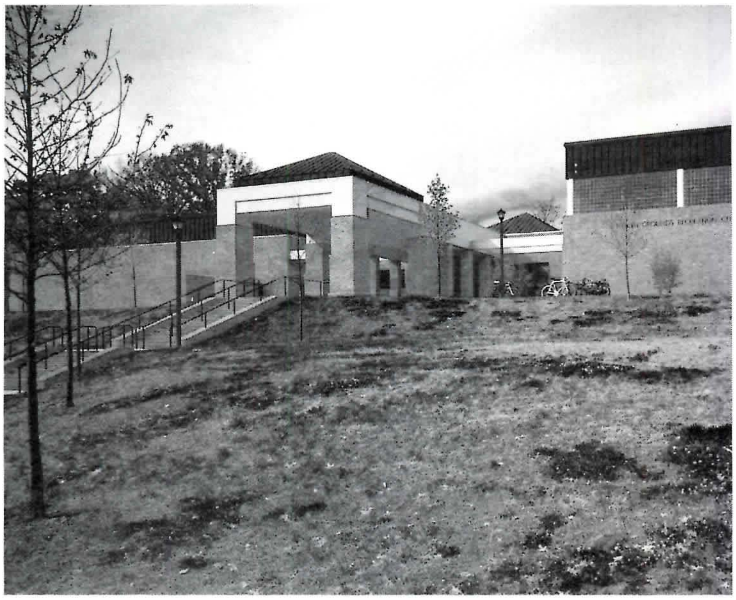








Below left, recreation center by Richard Shank & Associates. Below, university hospital, under construction, a joint venture of Metcalf & Associates, Russo & Sonder, and Davis Brody & Associates. Brick base will house diagnostic services; white wings are positioned above service floor. Right, university's architectural roots: Jeffersonian colonnade edging the lawn.



Rosanna G. Liebman

Rosanna G. Liebman

lecture hall, symbols of the roles of an institution of learning. As with Jefferson's library, whose pantheon shape apotheosizes the primacy of learning, biblical and educational overtones are apparent on this building's face, which is inscribed with limestone "tablets" and a book.

A bevy of mediocre brutalist buildings that have yet to acquire a noble patina dominates the architectural style of the north grounds, an extension of the university tucked behind Route 29, Charlottesville's strip. University planners in the 1970s had the good sense to introduce curvy roads and cul-de-sacs à la suburbia, but access to the wooded enclave is got only via Shoney's Big Boy or along the parking lot of a mammoth sports complex and only—you guessed it—by car. With this extension the university plan, once and for all, lost coherence.

The north grounds, devoted to the schools of law and business and the U.S. Army's law school, had its own dormitories and food service but lacked a gymnasium. From the start, the cards were stacked against architect Richard Shank & Associates of Charlottesville—the site chosen for the new north grounds recreation center was a former dump with most trees removed, and, because the mini-village is so disconnected from the university, the Jeffersonian palette clumsily rendered here in unrelieved brick set in heavy concrete frames remains the context to which architects are compelled to respond.

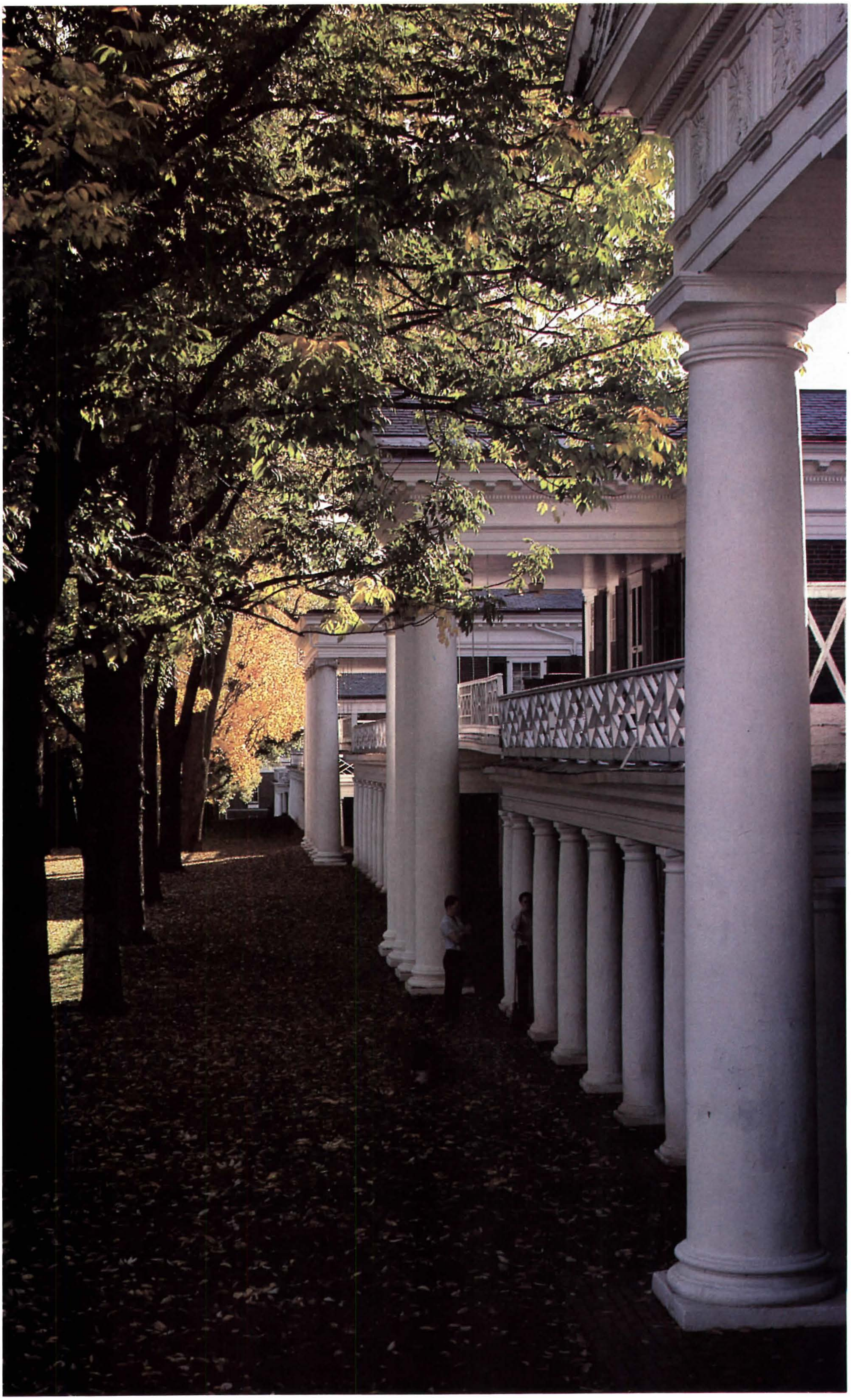
The recreation center was done on a design/build basis to force costs down. After budget, functional efficiency was a major concern, and the building does work well in terms of flow. Circulation from entrance to locker room to courts or weight room is clear to the first-time user. A prominent entrance pavilion reaches down to the bus stop and cannot be missed by people arriving from the parking lot to the north. A twin pavilion inside brings in clerestory light (the interior also is naturally lighted through glass brick in the basketball court and parallel glass walls connecting the weight room to the lobby). From this pavilion attendants can check I.D.s, dispense sports equipment, and, most important, monitor activity in all directions, so that the facility can be run with substantially fewer staff than any other gym on campus.

The somewhat Gravesian and very blocky exterior is relieved by subtle multiple water tables. Asked if the architects considered designing in an alternative material, Richard Shank, AIA, responded, "If you build at the university, brick is pretty much a foregone conclusion."

Not so at the replacement hospital, whose glaring white panels fly in the face of tradition. Still under construction, the hospital will replace the outdated facilities of what is considered one of the nation's top medical schools. In rough figures, this is a 160,000-square-foot, $200 million project that is already expanding as it is being constructed. The complex will consist of existing and new hospitals, old and new parking garages, a research building, an MRI (Magnetic Resonance Imager) building, and an enclosed, two-story skyway (one level for patients, the other for the public). The complex is the joint venture of Metcalf & Associates of Washington, D.C., Russo & Sonder, and Davis Brody, both of New York City. The former two firms, both specialists in hospital design, are responsible for patient and service floors and overall coordination and the diagnostic floors respectively. All three firms collaborated on the overall concept, which is to grow vertically from public to private space. Davis Brody developed the idea and gave it material and scale and also contributed to public spaces and skin.

The main hospital consists of a brick base, which contains diagnostic services, topped by three white tower wings (now four floors, soon to be six), each devoted to a different medical specialty and each serviced by its own intensive care and nursing unit. Sandwiched between the base and tower is a service floor, which lessens mechanical runs up and down the building.

Needless to say, those white towers are a subject of controversy. Never has anyone dared so flagrantly to break the brick injunction, but then again the unwritten rule that no building supersede the spring line of the rotunda was violated years ago. The architects weren't looking to be disrespectful—they recognized that a brick building of this proportion would create a greater visual mass than white aluminum panels that blend with the sky on cloudy days and seem to float and demass the volume in the sun. Despite the brouhaha, this is by no means a full-blown exercise in modernism, nor is it acontextual. The bridge's copper roof is indigenous to the university vocabulary; pale green panels break up the white mass and recall the same patina; and there is the brick base. By introducing new materials, this building designed by out-of-towners may also pave the way for new architectural options for the University of Virginia. □



Allen Freeman

© Richard Payne, AIA

Expanding 'an Extraordinary Spectacle'

Planning and design of the Rice University campus. By David Dillon

First impressions of the Rice University campus verge on the apparitional. A long ceremonial drive neatly bisects a dense triangle of live oak trees, like a diagram in a geometry textbook, and stops finally before the triumphal arch of the Administration Building, a combination medieval fortress and Venetian palazzo. The view narrows here, then opens out again to reveal a broad green squared up by low, slender buildings with deep arcades and fanciful tops.

Biologist Julian Huxley, a member of the original Rice faculty, described this scene as "an extraordinary spectacle, as of places in a fairy story. The Administration Building was before us, looking exactly as if it had arisen directly out of the earth.... The high rounded windows, the lavishness of color and decoration, conspired with the simple and modern form to produce an effect entirely original. Here it stood brilliant, astounding, enduring, rising out of the barren brown prairie which extended, unbroken save for a belt of trees, to the horizon and far beyond."

The focus of Huxley's epiphany was understandably Rice's flamboyant Mediterranean Gothic architecture, but today we recognize that it is art and nature together, the buildings with their framed views *and* the many belts of trees, that make the campus special. Rice has a Mediterranean quality, open to the elements yet with a strong sense of protective enclosure provided by its many arcades, loggias, and courtyards. It is a scholarly retreat, almost monastic in its serenity, and therefore a perfect counterpoint to Houston, one of America's most frenetic, auto-obsessed cities.

Rice began as 300 acres of flat, boggy, insect-ridden prairie, all purchased with a $10 million endowment from Houston merchant-philanthropist William Marsh Rice. Rice's goal was to establish a tuition-free technical institute similar to Cooper Union in New York City, grounded in science and math, with a smattering of the humanities. William Rice was murdered in 1900 by his valet, and four years and many legal battles later his endowment passed into the control of the institute and eventually to its first president, Princeton astronomer Edgar Odell Lovett.

Left and above, the Rice quadrangle. Foreground building in aerial photo is the Administration Building, Lovett Hall.

From the beginning Lovett envisioned Rice as a national university, not a provincial backwater. He worked to broaden the curriculum to include more arts and humanities. He also insisted that Rice be as distinguished architecturally as academically. In 1909, after a year of travel and consultation, he chose the firm of Cram, Goodhue & Ferguson to produce a master plan for his fledgling institution, along with designs for its first buildings. The initial meeting between Lovett and his architects, recounted in Ralph Adam Cram's autobiography *My Life in Architecture,* testifies to Lovett's singleness of purpose and his indifference to daunting physical circumstances.

"One day into my office came a former member of the Princeton faculty," wrote Cram, "who delivered himself substantially as follows: 'We have, three miles outside the city of Houston, Texas, a tract of three hundred acres; it is fifty feet above sea level and fifty miles from the coast; sometimes the water covers a portion of the site, as the fall is only one foot per mile to the sea. It is bare prairie land, with a few scrub oaks in one corner. We have a fund of ten million dollars, some of which can be used for the first buildings. We have a Board of Trustees and a President—myself—and we should like you to be our architect.' Thus Doctor Lovett, President of the then non-existent Rice Institute."

Cram, Goodhue & Ferguson drew up numerous general plans, each formal and strongly axial yet differing in the arrangement of individual buildings. (All are meticulously described in Stephen Fox's definitive *The General Plan of the William M. Rice Institute and its Architectural Development.*) In some versions the major buildings are grouped densely around the main quadrangle; in others they are dispersed more loosely about the site

© Richard Payne, AIA

so that the landscape becomes as significant as the architecture. Several versions contain Persian gardens and reflecting pools designed by Bertram Goodhue, the most buoyantly eclectic of the partners. Buildings typically were grouped according to function, with the residential colleges located to the south of the main quadrangle and science and engineering buildings to the north.

The final plan, adopted in 1910, shows the Administration Building (now Lovett Hall) straddling the main axis like a colossus. In the foreground stand a fine arts building and a women's dormitory; behind, toward the west, is the main quadrangle or "academic court" flanked by laboratory buildings and closed by Goodhue's domed and polychromed auditorium out of *A Thousand and One Arabian Nights*. The main axis is bisected by four cross axes that organize the site into a network of major and minor quadrangles, each autonomous yet also expressive of the larger whole. It is a grand plan in the Beaux-Arts tradition, an idealized vision of possible futures as well as a pragmatic response to immediate needs.

To flesh out their plan, Cram, Goodhue & Ferguson created an architecture at once monumental and delicate. "Created" is the appropriate term since nothing about Houston demanded the soaring Gothic style that the firm had used so successfully at Princeton University and West Point. Neither Houston's semitropical climate nor its lack of cultural tradition favored such loftiness. Cram detested the Spanish colonial style, and the Rice board of trustees wanted nothing to do with things Mexican. In the end Cram turned to the Mediterranean, marrying selected elements of his beloved Gothic with details cribbed from dozens of picturesque sources. "I had travelled much in Mediterranean lands and was familiar with their architectural documents," Cram noted in his autobiography, "so I reassembled all the elements I could from southern France and Italy, Dalmatia, the Pelopennesus, Byzantium, Anatolia, Syria, Sicily, Spain, and set myself the task of creating a measurably new style that, while built on a classical basis, should have the Gothic romanticism, pictorial quality, and structural integrity."

Architectural historians have since amused themselves tracking down Cram's models, which range from the monastery of St. Luke of Stiris in Greece to Nicholas Hawksmoor's unbuilt

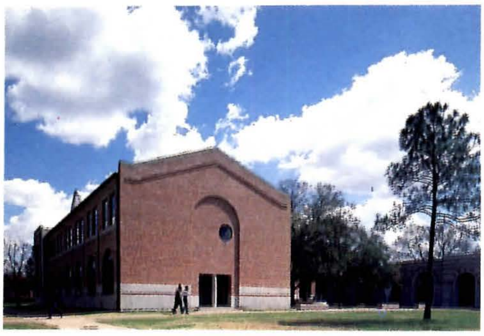
Left, framed view of quadrangle through the trees. Ralph Adams Cram in his autobiography wrote that he sought a 'new style that, while built on a classical basis, should have Gothic romanticism, pictorial quality, and structural integrity.' Below, Rice campus plan completed in 1983 by Cesar Pelli, FAIA.

Fellows' building for King's College, Cambridge. Yet what impresses us today is how Cram, Goodhue & Ferguson managed to combine these far-flung influences into a visually stimulating and intellectually rigorous architecture. Their starting point was the network of greens and quadrangles, around which they placed low rectangular buildings joined by arcades. This arrangement was a sensible response to Houston's steamy climate as well as an expression of Cram's reverence for the plans of medieval universities. The cloister and the courtyard at Rice proclaim "university," thereby conveying upon a new institution in a young city the imprimatur of seriousness and high purpose.

The fairy-tale quality noted by Huxley and others is a function of the lavish ornamentation on the major buildings. Moorish, Byzantine, classical, and Gothic details intertwine to create dense, richly textured facades that dance in the southern light. The buildings are constructed of pinkish St. Joe brick laid in intricate decorative patterns, with limestone banding and sloping red tile roofs. The columns that form the ubiquitous arcades and loggias are slender and ornately capitaled, while the enclosing walls are covered with marble, tile, and whimsical reliefs, including one of the Rice owl. Few surfaces are left blank, and no opportunity for sensory stimulation has been resisted. Cram was particularly adept at varying the dimensions of his windows, both to differentiate the functions within the building and to lighten what would otherwise have been oppressive horizontal forms. At the same time, the combination of tall windows, pitched roofs, and playful roof turrets creates a surprising sense of verticality in these low buildings.

The character of the Rice campus remained intact until the late 1940s, when Staub & Rather's Fondren Library, one of the first post-Cram buildings, was completed. A ponderous, hunkering building located where Goodhue's flamboyant auditorium was meant to go, it not only closed the main "academic court" but by its bulk suggested an end to growth as well. But Rice continued to expand. Another 12 buildings and nine residential colleges were added over the next 35 years, along with a new administration building and several major additions.

While the new buildings generally respected the principles of balance and axial alignment found in the 1910 general plan,



Allen Freeman

© Richard Payne, AIA

© Richard Payne

many ignored earlier recommendations about scale and architectural details. Quadrangles became loose and uncontained, building design grew slack and conventional. The various buildings in the Science Court, designed in the '50s and '60s by Pierce & Pierce, represent an unhappy marriage of Cram's ideas and mainstream modernism. Edgar Odell Lovett College, completed in the 1960s, is a heavy-handed brutalist assault on the Rice vernacular, complete with crude precast detailing and a Byzantine interior plan. Several high-rise dormitories appeared on the fringes of the campus. Given the strength of Cram's original plan, these departures were not calamitous; at the same time they aroused fear that the Cram, Goodhue & Ferguson legacy would not survive. It is all the more surprising, therefore, that the task of rehabilitating the 1910 general plan should fall to two aggressively individualistic architects: James Stirling, Hon. FAIA, and Cesar Pelli, FAIA.

Stirling was commissioned in 1979 to design an addition to Anderson Hall, a 1947 Staub & Rather building later taken over by the school of architecture. Stirling has described the project as "quiet, reserved, and conventional," and it is all of these things, perhaps too much so. His work blends almost imperceptibly with the original brick and stone structure. Except for two futuristic turrets over the new entrances—entirely appropriate details for a Rice building—it is difficult to tell where Staub and Rather stop and Stirling begins. He maintained the roof lines of the older buildings on campus, borrowed his interior plan from Cram's Physics Building, and added graceful arched windows on the north facade to recall the familiar Rice arcades that in this case weren't built. Only when we pass to the interior—badly compromised by budget constraints and faculty squabbling—do we realize that we are in a new building, not an old one. While hardly a major work, Anderson Hall represents a tactful and self-effacing response to tradition.

In Herring Hall, home of the Jesse Jones Graduate School of Administration, Pelli offered a more spirited and adventurous treatment of the Rice vernacular. His design draws upon most of the basic Rice motifs: St. Joe brick and red roof tiles, arcades and courtyards, mature live oak trees. The building consists of two offset rectangles that slip past one another—another convention of earlier Rice buildings—with the two elements connected by colorful glazed galleries. Here and there the glazing and some of the tile work seem mannered, even polemical, but overall Herring Hall shows that respect for tradition needn't result in mindless mimicry of older architecture.

Pelli later designed an addition to the Rice Memorial Center across the green, an odd 1950s complex by Harvin C. Moore that is part student center and part chapel. Pelli's 1986 addition,

The three newest buildings at Rice are, counterclockwise from top left, Stirling's architecture school addition, Pelli's Herring Hall (also in aerial foreground, right), and Pelli's new Ley Center.

known as the Ley Center, contains offices, meeting rooms, and a dining hall. Appropriately finished in traditional Rice brick and tile, the result lacks the energy and finesse of nearby Herring Hall, particularly in its detailing.

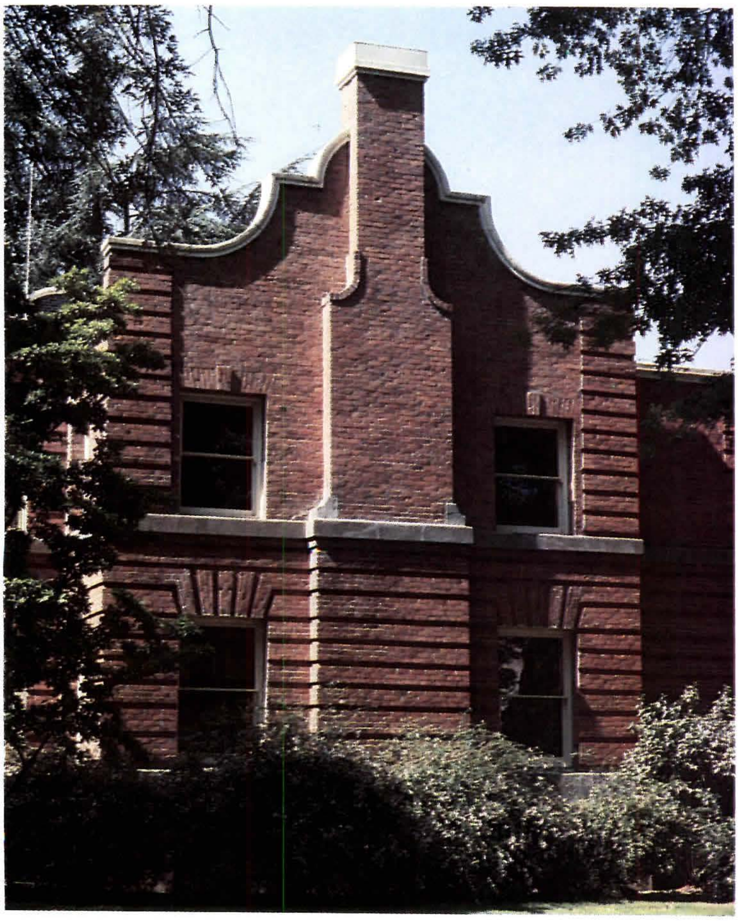
The Rice trustees were so impressed by Pelli's care in siting Herring Hall that they commissioned him to prepare a master plan for the growth of the university's academic and residential facilities. Completed in 1983, the new plan is a reaffirmation of the best features of the 1910 general plan. It emphasizes the importance of greens, quadrangles, and other open spaces and the need to link them by arcades and walkways. It underscores the need to maintain modesty in scale and to respect the materials and architectural forms of the original campus. It also places trees and landscaping on a par with buildings in maintaining the special character of the Rice campus. The plan recommends that whenever possible new buildings reinforce the existing patterns of axial organization and open space and not be allowed to become architectural islands. The underlying message is "fit in rather than take over."

A major test of the Pelli plan may now be under way. Continuing a long-standing practice of hiring internationally renowned architects for major campus buildings (and local architects for secondary ones) Rice has commissioned Ricardo Bofill, Hon. FAIA, to design the new Shepherd School of Music. The building will be located on the western edge of the campus, where it will face the blank rear wall of Fondren Library. It will respect the recommendations of the Pelli plan in its siting, but not in its functions. Pelli urged that the great mall be reserved for buildings that serve the entire university, such as a library or an administration building. The Shepherd School of Music is designed for a much smaller constituency.

Whether Rice will be able to rein in the architect of Le Viaduc and Walden 7 remains to be seen. Certainly no contemporary architect is likely to provide a severer challenge to the resiliency of the campus vernacular. And yet as Stirling and Pelli have demonstrated, the Rice style is not a straitjacket that confines architects to cautious, middle-of-the-road designs. It is a versatile medium filled with surprises and suggestive clues. The architects who have done best at Rice have seen it as a means for investigating and reinterpreting tradition instead of as an impediment to self-expression. That's more or less how Cram, Goodhue & Ferguson approached their commission nearly 80 years ago, and the results speak for themselves. □

The Built Results Of Alexander's 'Oregon Experiment'

How it has shaped the Eugene campus over 15 years. By Jerry Finrow



© Lawrence Finrow

In the early 1970s, after extensive consultant interviews, Christopher Alexander's Center for Environmental Structure was asked by the University of Oregon to develop a master plan for the university campus. Instead of the traditional master plan, the center proposed to develop a planning process for the university, which is documented in Alexander's book *The Oregon Experiment* (Oxford University Press, 1975). This article examines the results of this planning process, which has guided campus development for the past 15 years.

The University of Oregon campus, the state's principal public liberal arts university, was founded in 1876 in Eugene. Located between the Willamette River to the north and a continuous line of hills to the south, the site for the university sat on a shelf of high land at the southern end of the Willamette Valley, which was the western terminus of the Oregon Trail.

The campus first was organized into large, open quadrangle spaces flanked by three- and four-story red brick buildings. Major streets and walkways were planted with Douglas fir and native oak trees, which, in the 100 years since their planting, have matured and created wonderful tree-lined alleys and axial vistas from street to quadrangle to building couryard. Distant views of the Willamette Valley and the south hills beyond the campus form a backdrop to the lush foliage and broad open spaces that organize the campus. It is an appealing place.

The campus had a number of planning phases prior to the Oregon Experiment. In its first phase, from the beginning until 1914, the campus lacked coherent planning. Several buildings that all related to Deady Hall, the first university building, formed the original campus quadrangle. The second planning phase began in 1914 when Portland architect Ellis F. Lawrence was invited to be the campus architect. He developed an excellent campus plan modeled on the best precedents of his time. The Lawrence phase lasted from 1914 until his retirement in 1961. In 1960 the university employed Lawrence Lackey, a campus planning specialist, to assist the university in developing a new plan based on "functionalist" principles. Unfortunately, the areas developed during this period lacked the sense of scale, detail, and richness present in the rest of the campus and are the areas in greatest need of repair and improvement.

A "drawn," physical plan illustrating what a campus could become is traditionally the result of a campus planning process. The Oregon Experiment is quite different in that it describes a planning process that does not use a drawn plan as the basis for achieving order in the campus environment. Order is derived from the implementation of six planning principles that guide campus development. The essential aspects of these principles are quoted below from *The Oregon Experiment.*

Organic Order: "[P]lanning and construction will be guided by a process which allows the whole to emerge gradually from local acts. . . . The most basic fact of this process is that it enables the community to draw its order, not from a fixed map of the future, but from a communal pattern language."

Participation: "All decisions about what to build, and how to build it, will be in the hands of the users. To this end there shall be a users design team for every proposed building project; any group of users may initiate a project . . . [and] the time that users need to do a project shall be treated as a legitimate and essential part of their activities."

Piecemeal growth: "The construction undertaken in each budgetary period will be weighted overwhelmingly toward small projects. To this end . . . equal sums shall be spent on large, medium and small building projects, so as to guarantee the numerical predominance of very small building increments."

Patterns: "All design and construction will be guided by a collection of communally adopted planning principles called patterns." Patterns developed for the Oregon Experiment dealt with such issues as a desirable growth rate for the university, the relationship of the university and the town, knitting the living and learning environments together, departmental identity, and integration and the character of common spaces.

Mr. Finrow is professor of architecture at the University of Oregon.

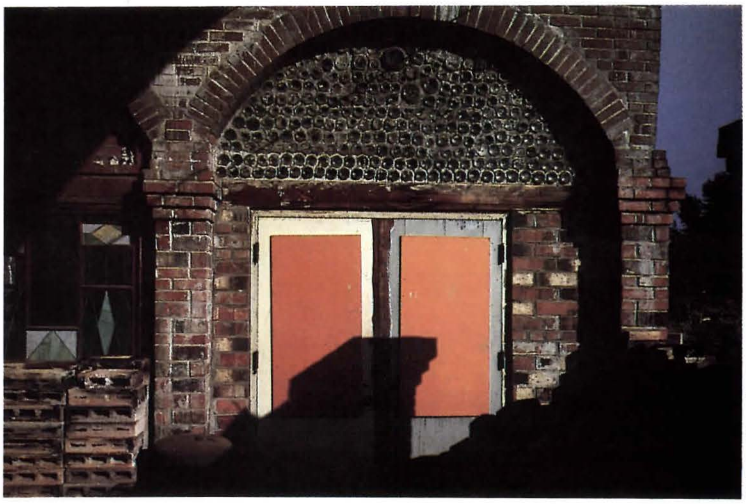
© Lucy Capehart

Diagnosis: "The well being of the whole will be protected by an annual diagnosis which explains, in detail, which spaces are alive and which ones are dead, at any given moment in the history of the community."

Coordination: "[T]he slow emergency of organic order in the whole will be assured by a funding process which regulates the stream of individual projects put forward by users. To this end, every project which seeks funds ... shall be submitted to the planning board ... [and every] project submitted for funding ... shall be put in order of priority ... by the planning board, acting in open session; at this session projects shall be judged by the extent to which they conform to the community's adopted patterns and diagnosis."

The process of planning and design that is recommended by the six principles of the Oregon Experiment has, to varying degrees, been implemented. Those aspects of the planning principles that relate to internal campus procedures have largely been carried out. The development of a planning and design process that is based on user participation is consistent with the decision-making traditions of the university. The campus planning committee, composed of faculty, students, and staff, functions in a way quite similar to that envisioned in the principle of coordination as described in Oregon Experiment. Projects always involve a user design group and have, to varying degrees, used the process of design described in *The Pattern Language* by Alexander.

While much of the Oregon Experiment is operational, the



© Lucy Capehart

© Lucy Capehart

Facing page, a characteristic work of Ellis Lawrence, campus architect for more than half a century. This page, the fine arts department's bronze casting facility. One of the first fruits of the Oregon Experiment, it was designed and built by students.

© Lucy Capehart

principle that has not been effectively adopted is that part of "piecemeal growth" that deals with the order of project funding. Long-range budgeting processes should ensure equal consideration of large and small projects. Unfortunately, this has not been the case. Capital construction is highly situational, making rational and systematic capital planning difficult. At public universities, project funding is a politicized process that has only limited concern for overall campus environmental quality. It has been difficult to alter this funding tendency.

A second problem with the implementation of the Oregon Experiment is that support for the office of campus planning has not been at the level recommended by the Oregon Experiment. As a result, the annual diagnostic studies, which involve continual analysis of the campus, have not been carried out with the degree of depth and precision envisioned. The intent of the diagnosis is to produce campus maps that document the evaluation of the campus in terms of the patterns and make recommendations for specific projects that would improve the "architecture" of the campus. Many of these would be modest projects such as tree planting, ground surfacing, or moving a parking area. Maintaining the campus diagnosis is important because it requires continual assessment of the campus environment in order to identify projects that could incrementally improve the quality of the campus.

The planning office has only enough staff to handle specific, funded building projects. The development of new patterns to supplement the original pattern list has also been very limited. While specific building projects have strong and aggressive advocates, there are few who actively support the overall campus environment.

Finally, architecture firms have had difficulty working sympathetically with the pattern language design process. Architects are quite comfortable communicating with campus users in the context of a highly controlled "review" situation, but working directly with users and keeping accurate notes concerning design decisions has led to difficulty. The Oregon Experiment is based on a high degree of user involvement in the design of projects on the campus. The process involves architects and users meeting to discuss and decide based on clearly stated design principles (in this case, patterns). The principles discussed are taken seriously as policies that guide project design. The sequence in which these policies are reviewed is important because it establishes a publicly accessible hierarchy of decision making that must be fully and accurately recorded.

To be successful in using this procedure for design, architects must be skilled in working within a policy-oriented design framework. Many architecture firms are not used to sharing design decision making or to operating in such a public process. They find working in such a way to be frustrating and time-consuming and feel that the designs are not as good as when architects do the work with less direct user input. In past projects intense conflicts have resulted from the users' desire for participation and the architects' desire for control. Success in user-oriented design must come from the architects' desire to be open, to listen actively, and to be vulnerable to the genuine concerns of users. Democratic processes of planning and design are not easy, but they are important in order to make projects responsive to a broader range of concerns than just those of the architect or the facility administrator of an institution.

There have been four phases of building on the campus since the adoption of the Oregon Experiment—the phase of design/build experimentation, the exploratory phase, the phase of inactivity, and the current phase of intense activity.

Several small projects were developed during the first phase that were designed and built mostly by students. The most notable projects of this period include the Kincaid Street Bus Shelter and the Bronze Casting Facility for the department of fine arts. The most interesting aspect of these projects was the opportunity for construction experimentation. The bus shelter used wood lath and burlap as permanent formwork for an unusual lightweight concrete roof vault system, which was later used in the Mexicali housing project developed by the Center for Environmental Structure and described in the book *The Production of Houses,* by Alexander, et al. The bus shelter was demolished in 1987 to clear a site for a new building for the school of business. The bronze casting facility utilized a composite construction system involving lightweight concrete as well as brick barrel vaulting.

During the exploratory phase, the first project to fully utilize the pattern language design process with an architecture firm was the school of music remodeling and additions. The program for the project involved the design of a new classroom and office wing and several large practice halls and extensive remodeling of the existing buildings.

The complexity associated with implementing an unfamiliar design process along with a limited budget made this project especially problematic. The architects found the user-based process of design to be complex and confusing, with the result that much of the design decision making was done with little user involvement. A review of the design proposed in the Oregon Experiment for this project compared with what was actually built demonstrates a lack of conceptual vision in the final

Facing page, two student works: at top, a bus shelter, demolished last year; below, the 'architecture graduate shelter' and 'urban garden.' This page, two early expansions under the Oregon Experiment: left, the somewhat miscellaneous school of music; right, the more sympathetically expanded school of education with its well-used courtyard.

© Lucy Capehart

© Lucy Capehart

© Lucy Capehart

© Lucy Capehart

project. While lacking the qualities of scale and richness that would have been expected, the design solution for the project does improve campus open space design in the area of the music school complex. A new wing of the existing music building formed an edge for a new central courtyard that is used as a setting for common activities and festive occasions for the school.

The firm of Martin, Soderstrom & Mattison of Portland was selected by the user group to design a major addition to the college of education. The late Willard K. Martin, the project designer, was interested in the pattern language design process and eagerly engaged users in a spirited design dialogue. The resulting project was sympathetic to the existing college of education building complex in position, form, scale, materials, and detailing. A new building element formed a major new courtyard, which has become the center of activity for the college. This project represents the best built example of the potentials of the pattern language design process used at the University of Oregon.

The economic recession of the late 1970s and early 1980s meant that capital construction for higher education was virtually eliminated. It was not until 1985 that significant new capital construction investments were made at the university. During this period the already limited staff of the office of campus planning was further reduced so that only minimal campus planning was carried out.

Because of the lack of state funding for capital projects, private industry and federal sources for construction funding were solicited. This activity, while important to the physical space needs of the university, led to new planning concerns—how to deal with capital gifts from private donors and the need for economic development became major factors influencing campus planning. Donors, of course, can pose problems for orderly campus development as they often expect to be able to make decisions regarding their donations, including the location of the project on the campus, the architect, and the specific project design.

The second major challenge to university planning procedure occurred as a result of the university's seeking to develop land that it owns for a research park. A plan has been proposed to develop university land located along the Willamette River north of the existing campus. In 1985, a group of students directed by Professor Donald Genasci of the department of architecture designed a plan for this area that won a *Progressive Architecture* design award. The university has sought to develop this project outside of the normal planning processes used on the campus in order to facilitate the interests of its private-sector development partner. The firm of ELS was employed by the developer to design a master plan for the area. The plan that has been proposed lacks significant site development criteria derived from the campus environment to which it is connected.

Buildings proposed for the research park have very big footprints that would create open space of inappropriate scale and complexity, ignoring significant campus open space concerns for axial vistas and definition of quadrangles. This plan has little to do with the Oregon Experiment, the previous plan developed by Genasci, or campus user concerns.

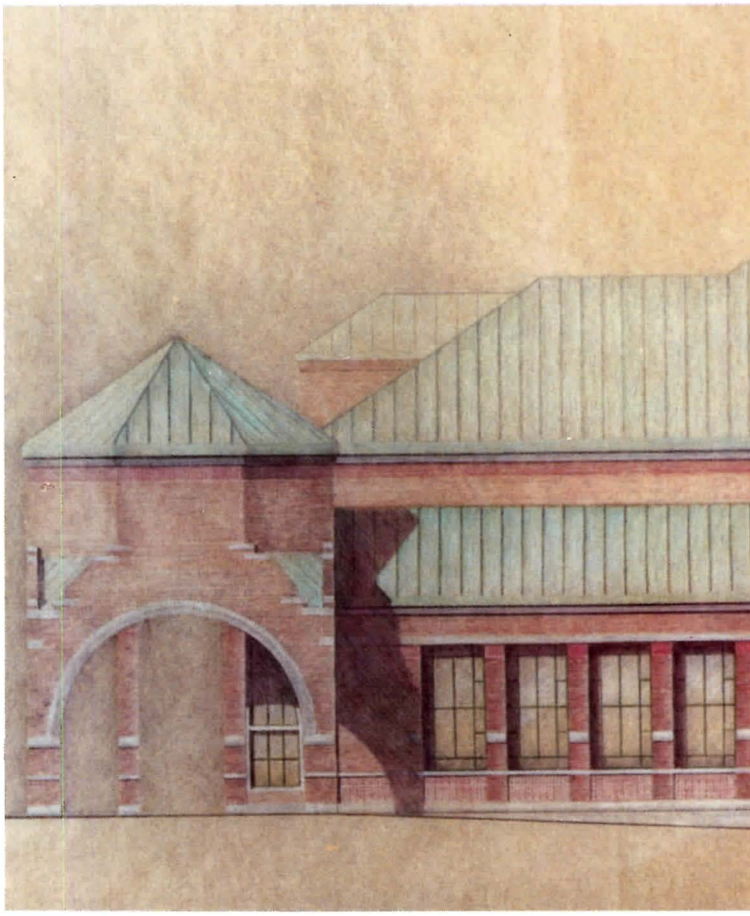
Recently two major projects have emerged that create an opportunity to improve architecture of the campus—the Oregon Institute of Marine Biology (OIMB) and the University Science Complex. The OIMB facilities are located about 70 miles west of the main campus in the Oregon coastal town of Charleston. The majority of buildings on the site were World War II barracks structures moved from Portland in the 1950s. Although in very poor condition, the OIMB facility had become an important part of the University of Oregon biology program. As project funding became available, the user group selected SRG Architects of Portland to design and carry out the development of the campus. The user design group worked together for an extended period of time to develop a site plan for the new campus. Using a modified version of the pattern language process, the architecture firm designed a facility that was derived from the spirit of the existing campus. The overall site plan retained much of the original character of the OIMB campus, with a number of shingled wood-frame buildings loosely organized around an internal circulation spine. A primary goal in the design of the project was to reinforce the visual connectivity between people working in the various buildings on the campus.

Some users felt that the project "gentrified" the previous spirit of the campus. More active listening on the part of the design team and the use of a systematic process of participation using patterns may have assisted project designers to gain clearer understanding of the fundamental character of the institute. In spite of these concerns, the architecture for OIMB creates a rich and supportive environment that has made a special place for education and research at the Oregon coast.

A sizable project to improve facilities for science education and research emerged on the northeast quadrant of the campus. The size of the project directly contradicts the principle of piecemeal growth described in the Oregon Experiment. It was anticipated that the project would involve construction of several buildings and extensive remodeling of existing science facilities. The size and timing of the project posed serious limitations on the use of the pattern language. The firm of Ratcliff Architects was selected as project architect, in association with Moore Rubel Yudell and Brockmeyer/McDonnell. Charles Moore, FAIA, was involved in user design group meetings for site development of the project. The pattern language was used to only a limited extent. Campuswide design decisions were addressed by a site review committee that worked with the consultants in user-directed design sessions that encouraged involvement of users but without significant pattern language input. As a result, user design sessions tended to lack direction and discipline.

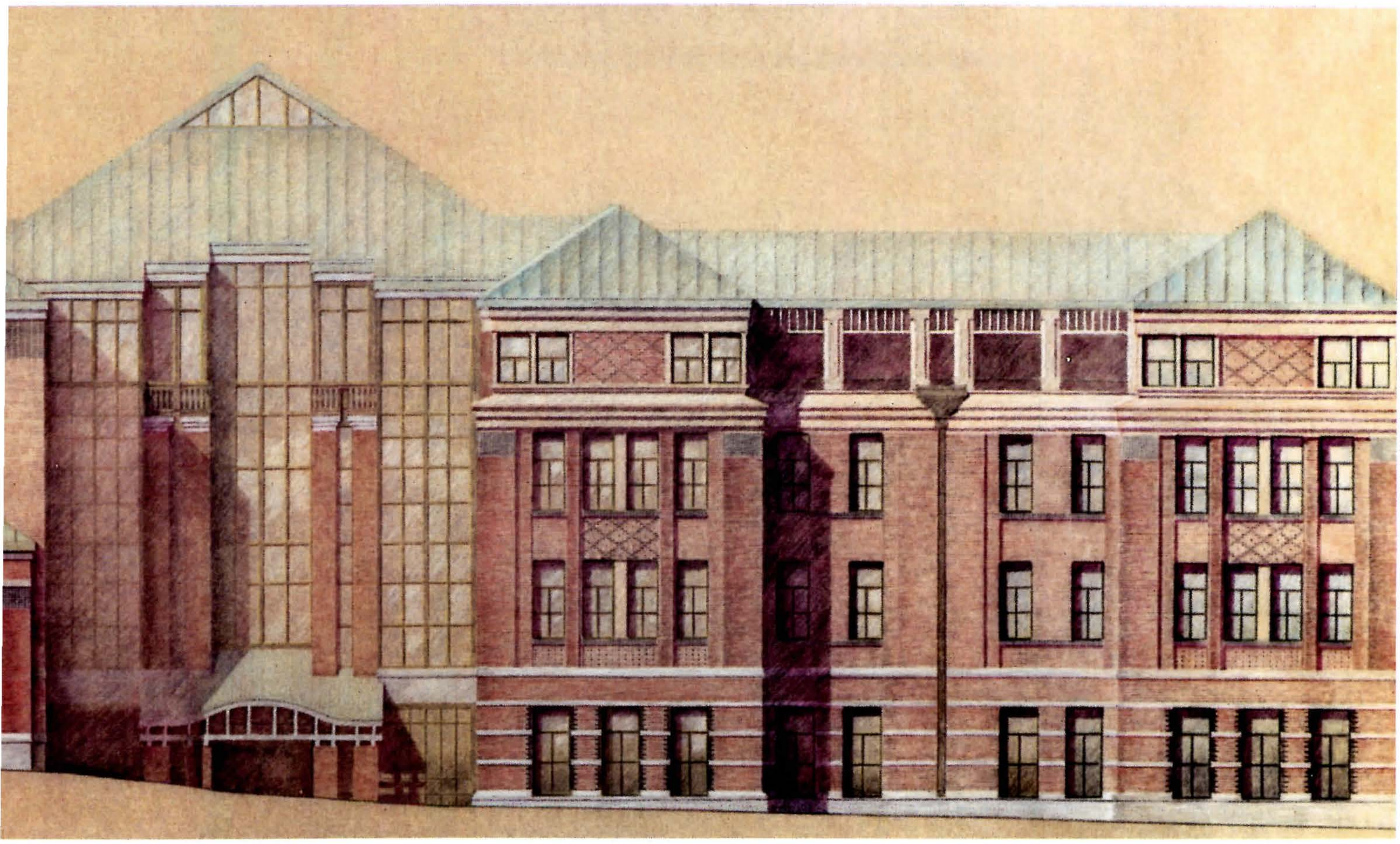
In spite of these shortcomings, the scheme for the science complex included the design of a major new quadrangle based on the principles of the traditional quadrangle system of the campus—the extension of the system of campus walks that facilitate internal project circulation, form interior courtyard spaces between buildings, and provide "positive outdoor space" in close proximity to buildings. In addition, the traditional red brick character of the campus was extended to include the precinct of the new science complex. The project is currently under construction and will have a major impact on the campus environment.

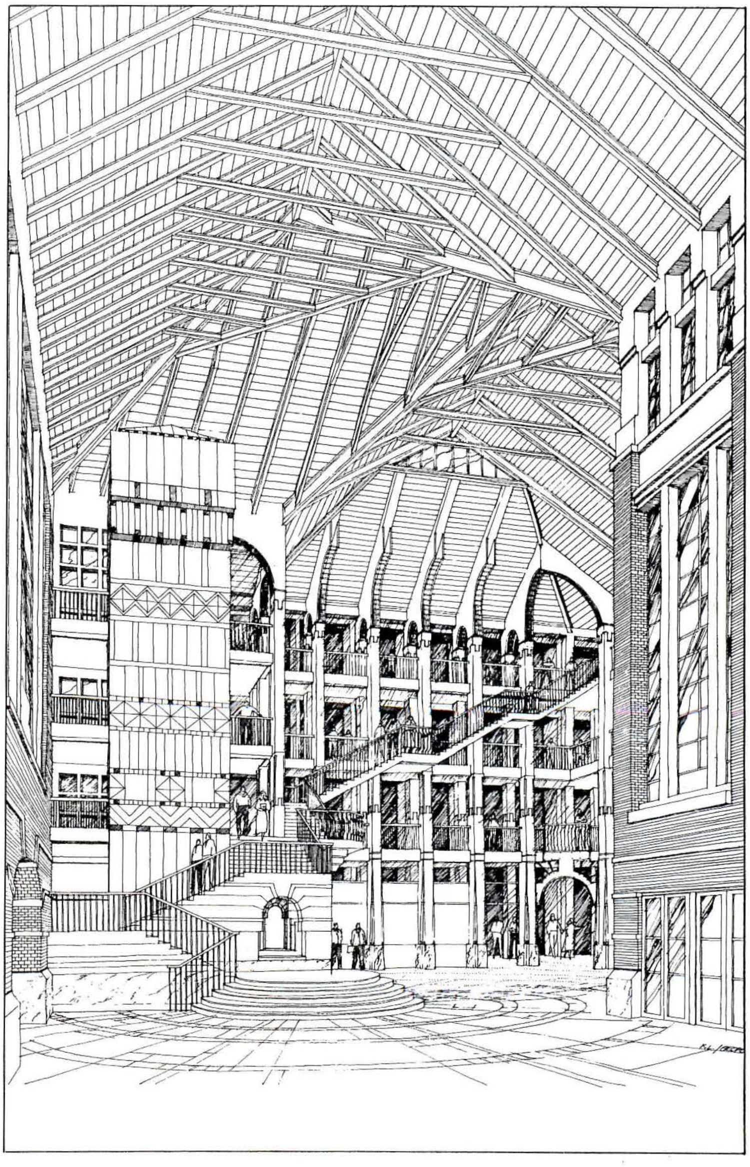
Two smaller buildings have been built that provide space for programs displaced by the science project. They are the Oregon Museum of Natural History and the North Art Site Millrace Studio. The Millrace project, designed with the firm of Brockmeyer/McDonnell, involved active use of the pattern language design process with considerable user input. These buildings are thoughtfully sited as part of a composition of building elements and were designed to create naturally lighted, high bay studio spaces. Notwithstanding some acoustical problems, the studio spaces work well despite their extremely economical construction.



© Ed Hershberger

© Lucy Capehart





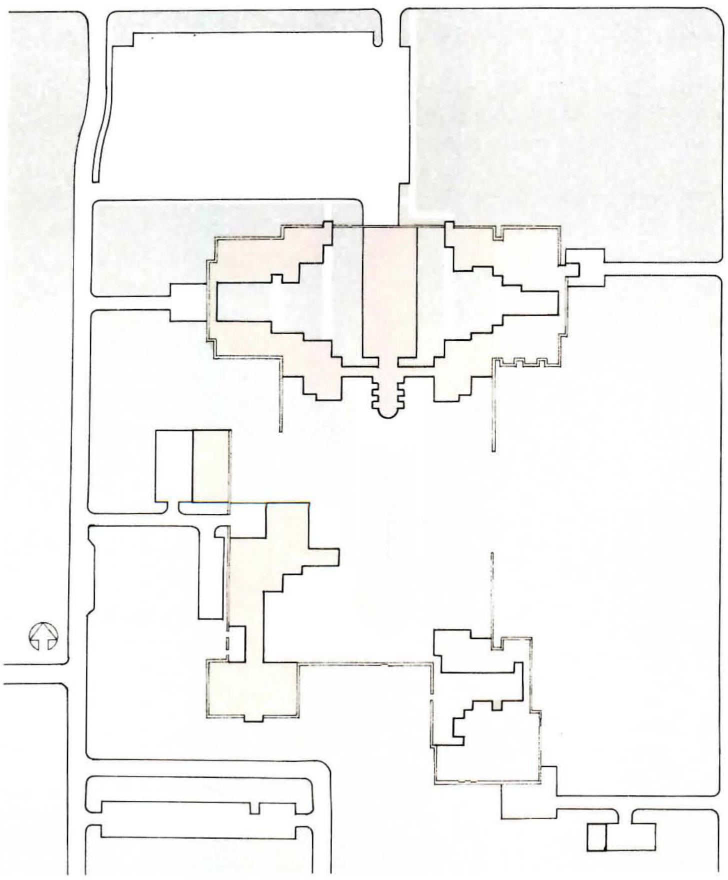
Left, two recent building projects that bear the imprint of Pacific Northwest regionalism; top, the Oregon Institute of Marine Biology on a coastal site some 70 miles west of the university's main campus; bottom, the Millrace art studios. Above and at right, a portion of the large new science complex now under construction as an extension of the campus, perhaps the university's most adventurous architecture in recent years.

In 1985, the campus planning committee conducted an internal evaluation of the Oregon Experiment process. The results of this evaluation were quite favorable, especially in regard to maintaining a user-based planning and design procedure. It appears that the Oregon Experiment will continue to be the policy of campus planning used at the University of Oregon.

Overall assessment of the success of the Oregon Experiment is difficult because a key aspect of the process has not been made a part of the planning procedure of the University of Oregon. In order to be fully effective, the Oregon Experiment recommends that reliable funding for a predominance of small projects be available. Such projects, initiated by users to address the needs disclosed by campus diagnosis, would allow incremental improvement in campus quality. The absence of such a policy, largely a matter beyond the control of the university administration, has limited the ability of the Oregon Experiment to facilitate substantial improvements to the campus beyond specific building projects.

Those aspects of the process that have been adopted as policy have been successful in guiding a user-based campus planning process. As a result the university has, over the past 15 years, retained much of the quality of its traditional campus environment. New construction and planned projects have had to consider broader campus design issues including the character of open space, the traditions of building materials, and the scale and detail of building facades. Users have been vocal in advocating both campuswide and detailed building design considerations with project architects. The adoption of planning principles has created a process for campus planning and design that has heightened the awareness of the campus community to issues of design quality. □

Photographs © Richard Payne



Form of barrel-vaulted entrance canopy, in top and middle photos, recurs as library roof, left. Vaults line up axially on plan.

New Campus Reflects Missions

Palo Alto College in San Antonio.
By Mike Greenberg

When the Alamo Community College District outgrew its original campus near downtown San Antonio, the district's administrators heard political demands to create a branch campus on the city's south side, a predominantly working-class and underdeveloped area that virtually stopped growing after the 1940s. It was hoped that the proposed college campus would be an economic generator and a reasonably convenient leg up for citizens in a part of town that had no other institutions of higher learning. When the first phase of Palo Alto College opened in early 1987, the neighborhood got something more—a proud, high-profile campus in which the imaginative use of inexpensive materials overcame the inevitable low budget.

The 150,000-square-foot first phase, including academic classroom buildings, the library, student center, and administration building, occupies one leg of a 100-acre, U-shaped site. Athletic facilities are planned for the other leg of the U, joined to the academic campus by a large parking lot. The project was designed as a joint venture of DeLara-Almond Architects Inc. and Jones & Kell Inc., both San Antonio-based firms.

Taking note of the changing role of community colleges, which increasingly serve the needs of people who haven't graduated high school and, in the words of John Kell, AIA, "are fundamentally afraid of institutions," the architects set out to create an easy-to-accept "pop" architecture in a nonthreatening environment. While the program's square footage could have fit easily and more cheaply into one somewhat forbidding multistory building, the need for a more friendly campus led to the decision for a cluster of small, one-story buildings.

Conveniently, a contextual model for this kind of plan was readily at hand. In both materials and site plan, the design was heavily influenced by the four restored or reconstructed Spanish missions that are strung out along the San Antonio River on the south side. The missions were walled compounds within which stood clusters of small, usually one-story buildings organized around open spaces. The most prominent building, placed along the compound wall, was the chapel.

Interpreting this scheme, the architects developed the perimeter wall as an organizing principle. Nine low, adobe-style buildings are arrayed around a variety of spaces, with a formal allée of red oaks on a lawn constituting the central plaza. An ingenious wall of split-face concrete blocks, with the mortar heavily smeared to suggest old stonework, encloses the collection. Between buildings, the wall is freestanding and helps form intimate courtyards; the same material is continued onto the building walls at the perimeter of the compound. The wall is penetrated at several points by formal entrances, and, on one side where the site rises slightly into a knoll, the wall is left open. The architects had planned a line of bald cypresses to continue the visual line of the wall, but the initial planting didn't take.

The perimeter wall looks persuasively, even from quite close, like rough-cut native sandstone. The blocks were custom tinted in three subtle shades—terra-cotta, gold ocher, and warm gray—that duplicate the sandstone used by architect Harvey Page in the reconstruction of the missions. A fourth tint, a slightly darker gold ocher, was used for the top course to suggest weath-

Mr. Greenberg writes about arts and architecture for the San Antonio Express-News.

ering. The masons had to learn to be careless: the first building erected, the central energy plant, turned out too neat and finished-looking, but by the time the masons reached the fine arts building they had the mortar gushing merrily. One of the charms of the wall is that it isn't uniform.

The forms of the buildings also borrow from the Spanish mission vocabulary. The dome form is interpreted as turrets of crossed half-circles in stucco, a leitmotiv that's repeated at least once on most buildings. The main part of the library is under a large barrel vault, where the nave would be in a church. On the interior, this barrel vault turns out to be one of the architects' few miscalculations—painted a stark off-white and uniformly lighted, it reads like a simple flat ceiling. Another part of the library occupies the semicircular "apse" under a shed roof. The barrel vault is repeated, on axis with the library and the central allée, in the middle of a lattice-shaded arcade where the entrance is planned for a future theater. The synthetic, sandy-textured stucco covers large areas without expansion joints and mimics the adobe construction of the Southwest. Finally, since the missions had to be defended, rifle loopholes reappear as clerestory lights above the main building corridors and at a few locations on the ground-floor level.

The low cost of the building system allowed the architects to put more amenities inside. In the fine arts building, a large lecture hall has a fully rigged and lighted stage—but not a full loft—allowing limited theatrical use until the large theater is built. In all the buildings, major corridors are topped by high clerestory vaults with handsome exposed trusses of bleached pine. Natural light during the day pours through the glass-block lights of the loopholes, supplemented by indirect fluorescents. At night, additional lighting is provided by artificial clerestory

Left, exposed roof trusses in hallway of campus center. Above, vaulted fine arts building lobby doubles as exhibit space for student art. Right, interior courtyard of classroom building.

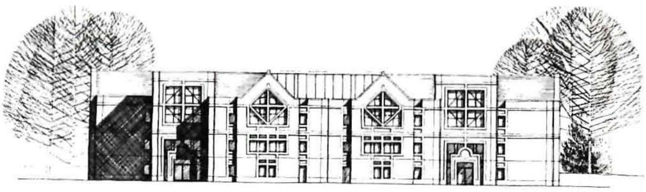
lights in the form of two-foot-square fluorescent panels, which form a line just below the loopholes. This lighting system is perhaps overly complex, piling form on form, and the artificial panels appear too often where they would make no sense as real clerestory lights, but on the whole the vocabulary is used well.

On the main building masses, four-foot-square window openings, glass-block loopholes, and eight-inch-square roof drains—alternating with single blue glazed tiles of the same size—form a limited vocabulary that is recombined in several ways, so that the exterior pattern varies subtly from building to building.

The overall adobe-and-stone color of the campus is relieved by red painted metal window frames and by single bright blue glazed tiles placed at wide intervals along the tops of walls and forming column capitals on the arcades. The same blue is used on metal bench frames in a semiformal plaza next to the administration building and student center, and a slightly clashing blue-green is used on custom-designed waste receptacle holders in this same area. Recesses at the building entrances are painted a cool blue to enhance the sense of depth.

Welcoming as the campus is on the inside, it is more intriguing seen from a distance. Approaching from the west on the expressway, the college's domes, clerestory towers, and perimeter walls rise from the surrounding brush country as in one's fantasy of a North African desert town. The impression is appropriate for a campus that was meant to be not an education factory but a learning oasis. □

Photographs © Richard Payne



'Stylistic Shotgun Wedding' on a Midwestern Campus

Library addition at Kenyon College,
Shepley Bulfinch Richardson & Abbott.
By Allen Freeman

Photographs © Nick Wheeler/Wheelerphotographics

After visiting Kenyon College in the tiny academic village of Gambier in central Ohio, you mostly carry in your memory the romantic setting. The campus approach, a steep rise from rolling farmland to a tree-covered ridge, is dramatic. And the college itself—stone-clad collegiate Gothic and neoclassical buildings under mature, spreading trees—is picturesque. But none of the buildings stands out as a landmark, including the newest, Olin Library by Shepley Bulfinch Richardson & Abbott.

Olin is an expansion of and is physically linked to Kenyon's 25-year-old modernist library, Chalmers Memorial. Chalmers became outmoded in 1964, just two years after completion, when the formerly all-male school went coed. Women's rest rooms and additional study space crowded Chalmers's stacks, which in turn were inadequate for an enrollment that soon doubled to 1,600.

The Chalmers-Olin union required a stylistic shotgun wedding that looks better than one might have expected, in part because Chalmers is largely obscured. For reasons of funding, the two had to maintain separate exterior identities, which precluded refacing the bland old building to match the new. Cruciform in plan, Olin stands 12 feet in front of the rectilinear Chalmers, the two mated by means of a glass walled connection. Olin might be considered an addition to Chalmers, but in function and size—Olin contains the entrances and primary vertical circulation and is 6,000 square feet larger—the reverse is true. Confusing the which-came-first question is Chalmers's subdued appearance and Olin's contextual gestures toward its funky old neighbors.

But Olin appears somewhat uneasy in its exterior identity, perhaps because its skin is taut, as in modernist buildings, but seems slipped over historical forms.

The architects pulled many of the right stops to make Olin fit in. (Sharing credit for the library are Shepley architects Geoffrey Freeman, AIA, Paul Sun, FAIA, who died while the project was well under way, Jon Ross, AIA, and Ray Warburton, AIA.) Olin neither towers over nearby buildings nor crowds its site. Like several neighbors, its entrances occupy the bases of towers, although the library's two "towers" are secondary to its dormered bays, and they read as chunky, receding corners. The elevations seem sufficiently segmented. And, though faced in precast concrete—exceptionally well finished in aggregate and smooth finishes—Olin has in common with Chalmers and other nearby buildings the colors of limestone and sandstone. But the skin itself could benefit from more articulation. The lighter, smoother precast accent banding is virtually flat; it casts no shadows and looks like ribbon

appliqué. And the windows seem overlarge and undersegmented in comparison with those of the older buildings.

Olin's great strength lies inside (photos overleaf), where attention to users' needs, predilections, and proclivities, to spatial relationships, circulation, and natural light, and to plain old function is exceptional. Olin has the qualities that bring a building alive, make it fun to use, and make it grow in one's affection.

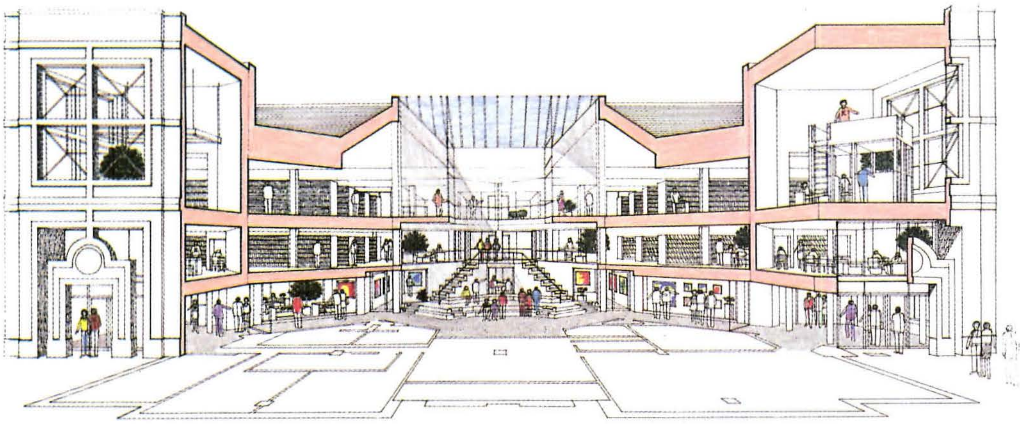
Behind each of the two corner entrances (which correspond to the most direct and well used building approaches) are small twin vestibules. From either of these you are drawn to the heart of the building, a three-story, naturally lighted room akin more in scale and feeling to modest 19th-century building courtyards than to grand hotel atria. Here during a recent visit I found students poring over books while sprawled prone on the central carpeted platform, hanging out around the vending machines on the periphery, and staking out seats on the second and third floors behind the glass walls, from which they can check out who is coming and going. The glass is here in part to keep noise from the library spaces, but little noise was being generated. Students seem to respect the space and others' rights to use it quietly. The room's glassy geometries rotate, mutate, and taper up to a peaked skylight, where reflections layer a pleasing visual complexity.

Above, Olin's front elevation, with attached old library visible in left of photo. Far left, the same corner viewed straight on.

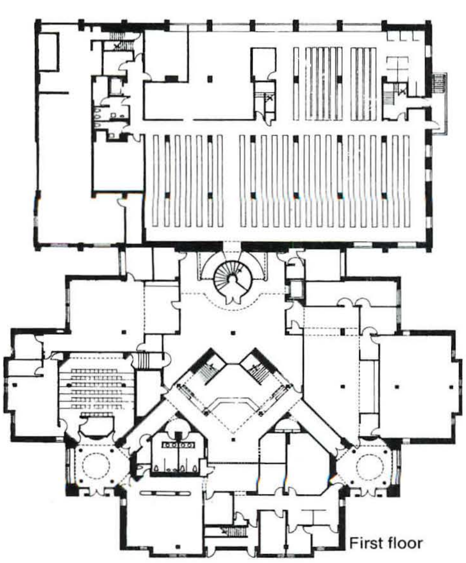
To enter the functioning library, which occupies the second and third floors of Olin and all three of Chalmers, you climb to the second level. The libraries' combined layout is a model of efficiency. A stairway spirals near the almost seamless junction of the two buildings, offices and rest rooms form twin cores flanking the stairs, and remote "tower" rooms at the corners provide splendid seclusion and views through the trees.

Back down on Olin's first floor, a series of rooms with uses not directly related to the library rings the atrium. These include the only misfire in the building, a somewhat awkward gallery interrupted by the foot of the spiral staircase; an intimate-seeming 70-seat lecture room in constant demand as one of the best—if not the best—on campus; the college archives; a video center; and a well used and pleasant 20-station computer center.

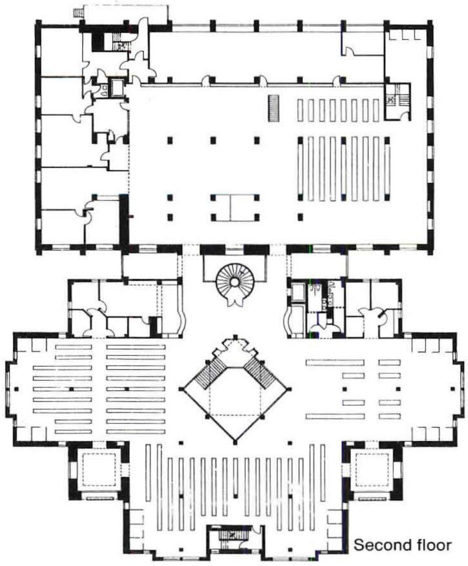
Staff, faculty, and especially students give the architects very high marks. Students "moved in" the day the building opened and immediately boosted book circulation by 40 percent, says staff member Allan Bosch. Says sociology major David Bartram, class of '88, "This is exactly the building that was needed. The old library was hell, and this is heaven."



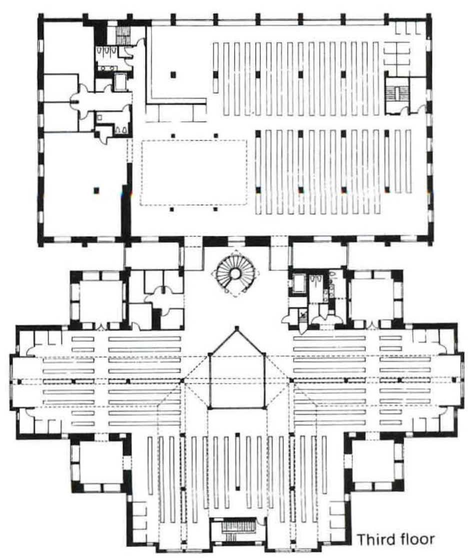
Left, Olin's atrium contains V-configured stairs to library entrance on second floor. The shape of the atrium changes from floor to floor, the space rising to a peaked skylight that is the centerpiece of the building's ridged cross-axis roof. Right, the view from the same angle two stories up, looking into the atrium through glass wall. Below, one of four corner tower rooms. In this one and its corresponding front-facing twin, study carrels form circles. Windowsills here are deep and inviting. □



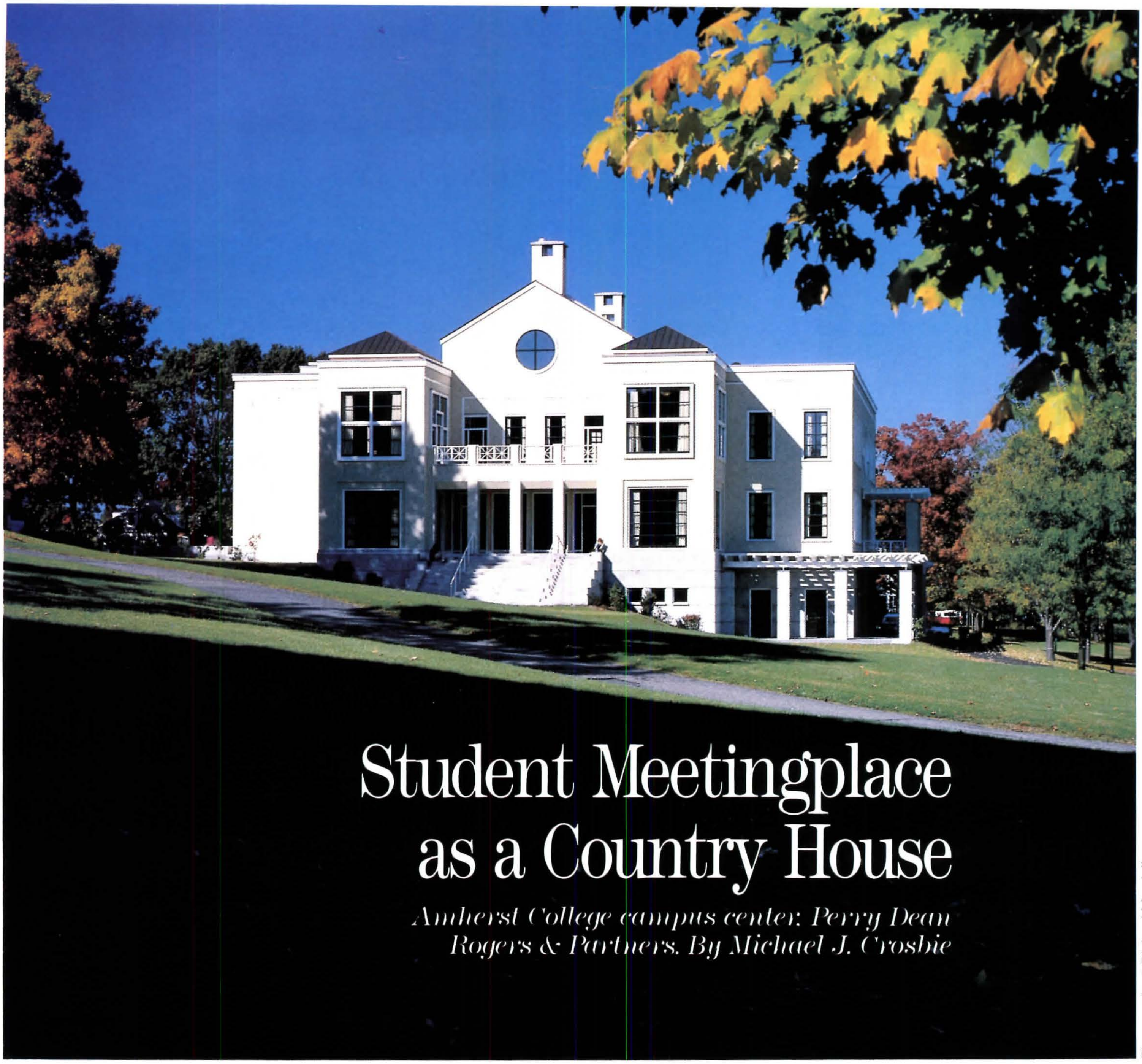
First floor



Second floor



Third floor



Student Meetingplace as a Country House

Amherst College campus center: Perry Dean Rogers & Partners. By Michael J. Crosbie

Photographs © Richard Mandelkorn

The campus of Amherst College in Amherst, Mass., rides a ripple of hilly terrain, its neo-Georgian brick buildings bobbing on a cascade of green. The Amherst quadrangle, virtually the only flat expanse on campus, falls away to the south and east, opening views of the mountains of west central Massachusetts. Sited just east of the quad, the Amherst College campus center, designed by Perry Dean Rogers & Partners of Boston, is not at the campus's center, but it occupies a spot at which intersect the pedestrian ways of faculty and students. For the students especially it serves as a way station on their daily trek from dormitories to classrooms to dining hall, a building through which they percolate and are certain to cross paths.

The 34,000-square-foot building contains all the program requirements you'd expect to find in a campus center: college post office, store, coffee shops, game rooms, study lounges, faculty conference rooms, student organization offices, assembly room. But visiting and using this campus center is not at all like visiting and using more typical campus centers, which are more akin to rest stops on a turnpike. The Amherst building is a big house with finely appointed living rooms for the grown-ups and family rooms with fireplaces for the kids, sunny south-facing porches and balconies, and a generous, two-story central hall with stairways tucked in its corners.

Steven M. Foote, AIA, partner in charge of the project, says the imagery that the center intends to suggest on its interior is that of a New England square or a big country house. The town green analogy is forced, but it has some currency when one considers that it is nearly impossible or just plain inconvenient to move through this building without skirting the central hall in the same way that one moves expeditiously through a New England town by circling or crossing its green. But the big house idea is alive in the center's every nook and extends to its exterior (to return outside for a moment).

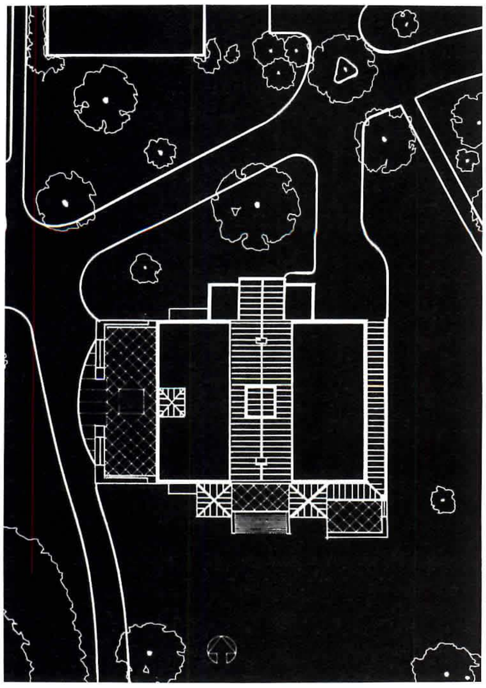
One's first impression of the center, its exterior rendered in yellow stucco, is of an alien building on a campus populated mostly with austere, red brick boxes. Foote says that brick was considered but seemed too heavy for a building of this size and massing. The campus's most idiosyncratic building, however, happens to be a yellow stucco octagon built at least a century ago, when a fad of octagonal buildings swept the Northeast. The octagon is nearly in sight of the center. Beyond the local context and the fact that the center *is* important and should stand out, the building shares an affinity with the big colonial houses found throughout the region. Its front facade is two stories and symmetrical and, like many of the area's finer houses, it sits on a granite base. A popular color scheme is yellow-painted clapboards with white trim and dark green shutters and doors.

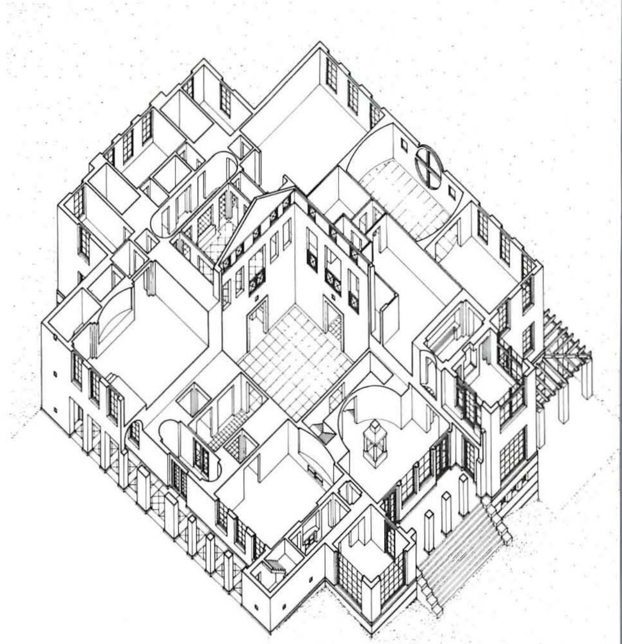
Yet the center has a Mediterranean air to it in its sun-washed exterior color and in its plan—a premodern, pinwheel arrangement of carefully shaped "chambers" with distinctive section profiles, which unfold off and constantly relate back to the central hall. In a warmer climate this hall would be roofless—in fact, its ceiling is painted sky blue—and the rooms around it would be open for cross ventilation. All of those allusions are intact here. The central hall has a granite floor and wainscot as if it were an outdoor space, with balconies and windows that open onto it. The intensity of its colors, especially in contrast to the red-stained oak, is on the heavy-handed side, but this space is otherwise a delight to pass through or observe from the balconies and rooms above.

The rooms are labyrinthine, their colors lightening from the basement to the second floor, and they present a continual convergence of axes and views from one to another, through the central hall—an artful layering of dark and daylighted spaces that have quite a punch for their small size. Spaces requiring little natural light—such as the post office, the store, a billiard room, and various service spaces—are well placed on the north side, while conference rooms, cafe areas, and study lounges enjoy southern light and have access to balconies and trellised porches. The largest room in the building, referred to as the "great hall," appears misplaced in its lack of southern exposure, yet its location over the main entrance is logical. It has the best relation of all the spaces to the central hall, however, with windows that open directly onto it, and is the only room that touches the central hall and an exterior wall.

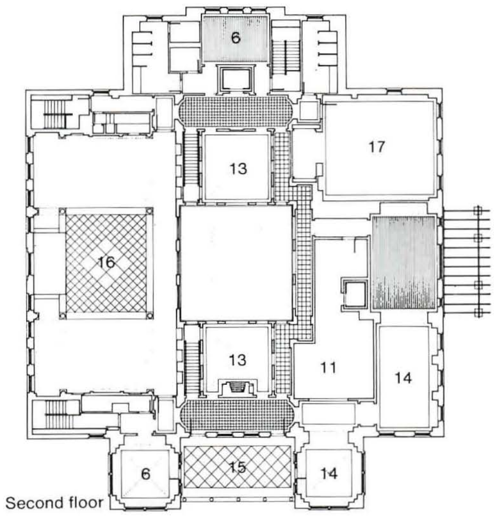
The plan of the campus center is very tight, with lots of exploration opportunities for those who will use it daily. Its student inhabitants, however, may feel uncomfortable in propping up their feet for fear of mucking up the woodwork. Sort of like being at home.

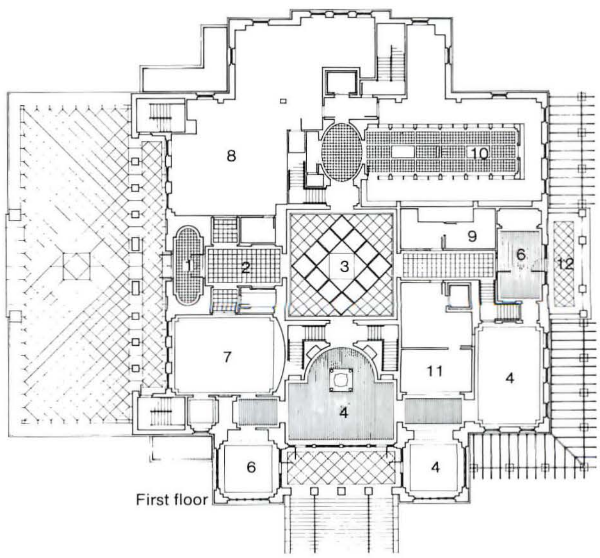
Facing page, top, campus center as it faces south; facing page, below, west elevation with building's 'great hall' extending across second floor and loggia on first floor. Below, southeast corner as approached from dormitories.





Left, from top, lounge with view toward cafe; 'great hall' with windows (at right in photo) opening onto central hall; cool and dark poolroom. Right, central hall and lounges. □





1 Entry
2 Lobby
3 Forum
4 Coffee
5 Porch
6 Conference
7 Living
8 Store
9 Office
10 Post Office
11 Servery
12 Balcony
13 Sitting
14 Dining
15 Terrace
16 Great Hall
17 Game

Photographs © Richard Mandelkorn

Let Your Imagination Soar...with the

PC GLASSBLOCK

Architectural Design Awards Competition

CALL FOR ENTRIES

Pittsburgh Corning Corporation is proud to announce an Architectural Design Awards Competition to identify, acknowledge and reward outstanding, creative and unique applications of PC GlassBlock® products. Projects to be considered are those which incorporate PC GlassBlock® products as a central element in their design. Applications may include exterior and/or interior as well as specialty constructions.

Through this program, Pittsburgh Corning Corporation hopes to heighten awareness of the special combination of aesthetic and functional characteristics offered by PC GlassBlock® products. It is also hoped that those in the architectural and interior design fields unaccustomed to working with glass block will be encouraged to consider the important design statement possible with this extraordinary building component.

Significant cash prizes will be awarded to all first and second place winners; certificates of recognition will be presented to all winners, including honorable mentions.

The Jurors

Judging will be by a panel of acclaimed professional architects—four partners/principals in leading architectural firms and the director of a major school of architecture.

James Ingo Freed, FAIA
Partner
I. M. Pei & Partners

Thom Mayne
Principal
Morphosis

Terrance Sargent, AIA
Partner
Lord & Sargent, Architects

Craig Taylor, AIA
Associate Partner
Skidmore, Owings & Merrill

Stanley Tigerman, FAIA
Director,
School of Architecture
University of Illinois
at Chicago

General Information

1 Projects To Be Considered
The competition will review exterior and/or interior as well as specialty constructions incorporating PC GlassBlock® products as a central design element.

2 Eligibility
The competition is opened to individual architects and designers and architectural/interior design firms in the United States and Canada, as well as to students enrolled in schools of architecture. School entries may also be by class, class team, or the school as a single body. Previously published entries are acceptable.

3 Judging Categories
Submissions are invited in three categories: (1) Existing/Completed; (2) Planned/Pending/In-Works; and (3) Conceptual. Designs may be for residential, commercial, institutional or industrial applications.

4 Entry Acceptance
Acceptance of entries for (1) Existing/Completed Projects and (2) Planned/Pending/In-Works Projects is contingent on verification of eligibility and agreement of the entrant's client to cooperate in the competition. All clients will be contacted and final acceptance rests with Pittsburgh Corning Corporation.

5 Awards
First and second place prizes will be awarded in all three categories, and up to three honorable mention certificates will also be awarded in each category, at the discretion of the jurors.

Prize Amounts

Project Category	1st Place	2nd Place
Existing/ Completed	$2,500.00	$1,500.00
Planned/ Pending/ In-Works	$3,500.00	$2,500.00
Conceptual	$6,000.00	$4,000.00

Note: In the event of student/school winners, prize monies may be divided at the discretion of the institution.

6 Notification of Winners
Winners will be notified by mail no later than April 22, 1988, and first and second prize winners will be honored at a banquet ceremony to be held May 9, 1988, in Pittsburgh, Pennsylvania. For student winners, travel and hotel expenses will be paid by Pittsburgh Corning Corporation.

7 Publishing of Winning Entries
There are a variety of ways in which winning submissions might be presented to the profession and the public at large. Publicity announcements will be submitted to the national and regional trade press, and to the local press in winners' areas. Winning entries may also appear in Pittsburgh Corning advertising. Thus, entrants agree that if their submission(s) wins, they release and authorize Pittsburgh Corning Corporation to use their entries in advertising and agree to provide additional graphic materials, if needed and available.

Submission Requirements

1 Entries may be made in all three categories but only one entry per category will be allowed.

2 Entries must be securely contained in binders no larger than 17" square (preferably 10¼" x 11½"). Fold-out sheets should not be used. Separate volumes must be submitted for each category entered.

3 A complete entry form (found elsewhere on this page) must accompany each submission. This form may be reproduced. Entry forms should be placed in unsealed envelopes attached to the binder's inside back cover. The entry form is the only document which is to identify the entrant(s). Any other submission materials which might disclose entrant identity must be modified in some manner so as to conceal this information.

4 Submissions should consist of color photographs, slides and/or transparencies for (1) Completed/Existing Projects, or legible reproductions of original drawings or plans for (2) Planned/Pending/In-Works or (3) Conceptual Projects. Models, videotapes and original drawings will not be accepted.

5 A typewritten project description sheet must accompany each entry in each category. These sheets should not identify the individual, firm or school entrant.

This sheet should appear as the first item in the entry volume and is to include:

A. Competition category for which this entry is being submitted: (1) Existing/Completed Projects, (2) Planned/Pending/In-Works Projects, or (3) Conceptual Projects.

B. For (1) Existing/Completed Projects and (2) Planned/Pending/In-Works Projects, provide the full name and address of the structure.

C. A general description of the overall project.

D. Where and how PC GlassBlock® elements are incorporated.

E. Why PC GlassBlock® elements were used and why only they could provide the aesthetic and/or practical function(s) sought.

F. Where possible, be specific as to PC GlassBlock® unit pattern(s), size(s) and type(s).

6 Entries will be returned only if a suitable envelope is included. A return label, which will be used on this envelope, is a part of the entry form. While submissions materials will be handled with extreme care, Pittsburgh Corning Corporation can assume no liability for loss or damage.

7 Entries must be submitted to:

Pittsburgh Corning Corporation
Architectural Design Awards Competition
800 Presque Isle Drive
Pittsburgh, PA 15239

Attention: D. Holland
Architectural Design Awards Coordinator

8 Entries must be to the above address by 5 P.M., Thursday, March 31, 1988.

9 For additional information, please contact:

Mr. James H. Coleman
Manager of Marketing Communications
Pittsburgh Corning Corporation
800 Presque Isle Drive
Pittsburgh, PA 15239
(412) 327-6100

PITTSBURGH pc® CORNING

Pittsburgh Corning Corporation Architectural Design Awards Competition Official Entry Form

(Please complete, cut from page and submit per Submission Requirements paragraph 3. Form photocopies are acceptable.)

Entrant:

Entrant Address:

Entrant Phone:

Credits for publication:

Category:

Project Name:

Project Location:

Client Name:

Client Phone:

Entrant:

Entrant Address:

Project Name:

The undersigned: (1) affirms that the submission was truly handled by the credited parties and meets all eligibility requirements; (2) acknowledges his authority to represent those credited; (3) understands that the decision of the judges is final regarding submission acceptance; and (4) agrees to allow public dissemination of winning submissions.

Signature: ______________________

Name (typed or printed): ______________________

Pittsburgh Corning Corporation
Architectural Design Awards Competition
800 Presque Isle Drive
Pittsburgh, PA 15239

Your submission has been accepted
and assigned entry number: ______________________

Entrant:

Address:

Project:

(Submission receipt)

Pittsburgh Corning Corporation
Architectural Design Awards Competition
800 Presque Isle Drive
Pittsburgh, PA 15239

Entrant:

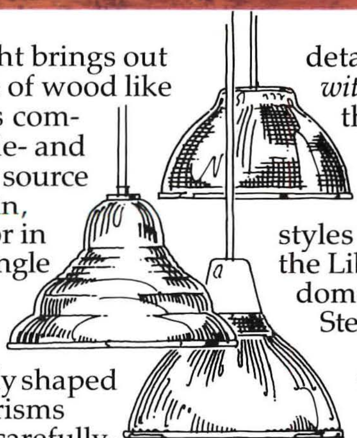
Address:

(Return label)

HOLOPHANE CLASSICS.
LIGHTING THAT PUTS NEW LIFE INTO WOOD.

Prismatic light brings out the richness of wood like nothing else. Its combination of single- and multi-point light source accentuates grain, texture and color in ways no other single technique can duplicate.

We use hundreds of precisely shaped and arranged prisms to direct light in carefully-determined patterns. Balancing the *overall output* so textural details can be highlighted, *without* washing out the subtle colors.



And Holophane® gives you three different prismatic styles to choose from: the Liberty™ (left), Paradome® (below), and Edmund Stevens™ (above).

Three elegant ways to highlight the natural beauty of wood.

For more information, contact your Holophane representative or write Neil Thompson, Holophane Division, Manville, 214 Oakwood Avenue, Newark, Ohio, 43055. (614) 345-9631.

HOLOPHANE
LEADER IN LIGHT CONTROL

Manville

Changing Rules on Change Orders

As stated in the new edition of A201.
By Dale Ellickson, AIA

Many, if not most, construction claims begin or end in a change order. The architect is just as often intimately involved in this process because of his or her agreement with the owner to administer the construction contract between the owner and the contractor. How to handle changes in the construction contract, and claims in particular, was of prime concern in the recent revisions of several AIA documents, including the 1987 editions of A201 and B141.

The practice of ordering changes in the work of the construction contractor after the work has commenced has long been common in the construction industry, principally because of the indeterminate character of the final design. Unlike a manufactured product, a building is usually one of a kind, built without a prior prototype or full-scale working model. Inevitably, changes will have to be made during the course of construction, either because unforeseen problems arise or simply because some new opportunity is discovered, which, if exploited, could benefit the owner's completed project.

Formal methods for ordering the construction contractor to change the work are prevalent in the United States and Europe and in countries that have followed American or European methods of construction contracting. Generally, it has been the practice under such contracts to give the right to the owner to change the scope of the work (but not the other legal obligations and rights of the construction contractor). This right of the owner is nearly unique to construction contracts, for seldom are similar provisions found in contracts outside of construction.

In Europe, where the idea of a change process presumably originated, a change is called a "variation." In the United States, the instruments used to effect changes are called "change orders," "change bulletins," "work directive changes," "amendments," "change directives," "modifications," and, most recently, "construction change directives." Terms vary slightly by region and even among individual architecture firms. To provide some consistency and standardization, the AIA's standard documents first incorporated a definition of "change order" in the 1966 edition of AIA Document A201, General Conditions of the Contract for Construction. Most recently, the 1987 edition of A201 has revised the definition of "change order" and has added the new term "construction change directive."

In the 1987 edition of A201, a change order is "based upon the agreement among the owner, contractor, and architect." Unlike the change order as defined in the previous edition (1976), a change order no longer embodies the unilateral right of the owner to change the scope of the construction work. This was the result of the recognition that most changes, documented by change orders, are in fact signed by the two prime parties and the architect and indicate the agreement of the parties to the change. The owner's right to change the scope of work regardless of the contractor's agreement has been retained but is now embodied in the new term "construction change directive." This instrument "requires agreement by the owner and the architect and may or may not be agreed to by the contractor" and is essentially an order to the contractor to perform the change.

It may be asked, "Why is the owner given the unilateral right to change the scope of the work?" Any change in scope may mean a change in the contract price or time limits. Shouldn't the owner and the contractor mutually agree on such changes? Theoretically, this would be the best course to take, but in practice the parties do not always agree on the adjustment to the price or to the time. For instance, suppose the owner wishes to change the flooring in a particular room from vinyl tile to ceramic tile. The contractor may respond with an unreasonable estimate of the cost. Is the owner prevented from having the change made? Will the owner have to live with vinyl tile, or change it after the contractor is finished, presumably at greater expense? Not necessarily. To counterbalance an unrealistically high price from the contractor, the owner retains the right, with the agreement of the architect, to mandate the change and have the price determined *after* the work is done for that change. This is now done through a "construction change directive" under Subparagraph 7.3.2: "A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order."

The contractor's recourse is to rely upon one of the four methods for price adjustment under Subparagraph 7.3.3. One of these methods allows the contractor to submit bills, purchase orders, receipts, and other supporting data to the architect for a determination. Likewise, adjustments in time are to be determined by the architect.

A theoretical model of the change procedure is shown in Figure 1. Provisions of A201 are noted at steps that specifically involve them. This is one way to view the change process, and steps may be condensed, combined, or simplified in other approaches. Obviously, not all the steps are mandated by A201. For example, a series of steps for soliciting and making a monetary proposal on an anticipated change is shown at the beginning of the process. Although not required, it is logical and a good business practice to predetermine the costs before the owner and architect execute a change order form (AIA Document G701) or a construction change directive (CCD) form (AIA Document G714). Solicitation may be done using AIA Document G709.

In some instances, the parties may skip this preliminary process altogether. In such a case, the architect will prepare a change order form (G701) with an estimated cost and send it to the owner and contractor in turn for their signatures and agreement. There is the risk of a disagreement sidetracking the procedure, however—it is possible that the contractor will disagree with the cost estimate. In the absence of a specific verbal agreement by the owner and contractor, the architect generally would do better to prepare a CCD. The parties then are positioned to proceed in one of two ways with the change—under the CCD if they do

---

Mr. Ellickson is senior director, AIA documents.

not agree on all the terms of the change, or under a change order if they do.

The chart shows there are at least four points, indicated by numbers 1 to 4, where a change order form might be prepared. The change order form is thus intended to document the entire mutual agreement of the owner, architect, and contractor, which may be reached at various points in the process. Note that while the CCD does not require the contractor's agreement, the contractor is given at least two opportunities to agree with it—once when the CCD is first presented to the contractor, and again when the bills have been evaluated by the architect after the execution of the work. As will be evident from the diagram, the goal is to obtain mutual agreement and bring the CCD to resolution as a change order. A201 clearly directs the parties to this goal in Subparagraph 7.3.5, which reads: "A Construction Change Directive signed by the contractor indicates the agreement of the contractor herewith, including the adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order."

Another revision in the 1987 edition allows for payment of the contractor under a CCD for amounts "not in dispute" (Subparagraphs 7.3.7 and 9.3.1.1). This change was made at the request of the contractors' representatives of the Associated General Contractors (AGC), who pointed out several instances where owners have unreasonably withheld funds. It is possible, for instance, that the owner and contractor may agree on the basic cost of the changes but not on the overhead and profit. It seems reasonable that the contractor should be paid for the basic costs that are "not in dispute." The other amounts (profit and overhead) could be determined later by the architect and, if one party disputes the architect's decision, by arbitration.

Some critics of the new A201 have pointed out that this new provision allowing for payment of amounts "not in dispute" under the CCD in effect converts the CCD to a time and materials contract change. Thus, they reason, the contractor should just submit the bills for CCDs along with the contractor's application for payments (AIA Document G702). This is an oversimplification, and it ignores the need to obtain the owner's agreement to the amounts attributed to the changed work by the contractor.

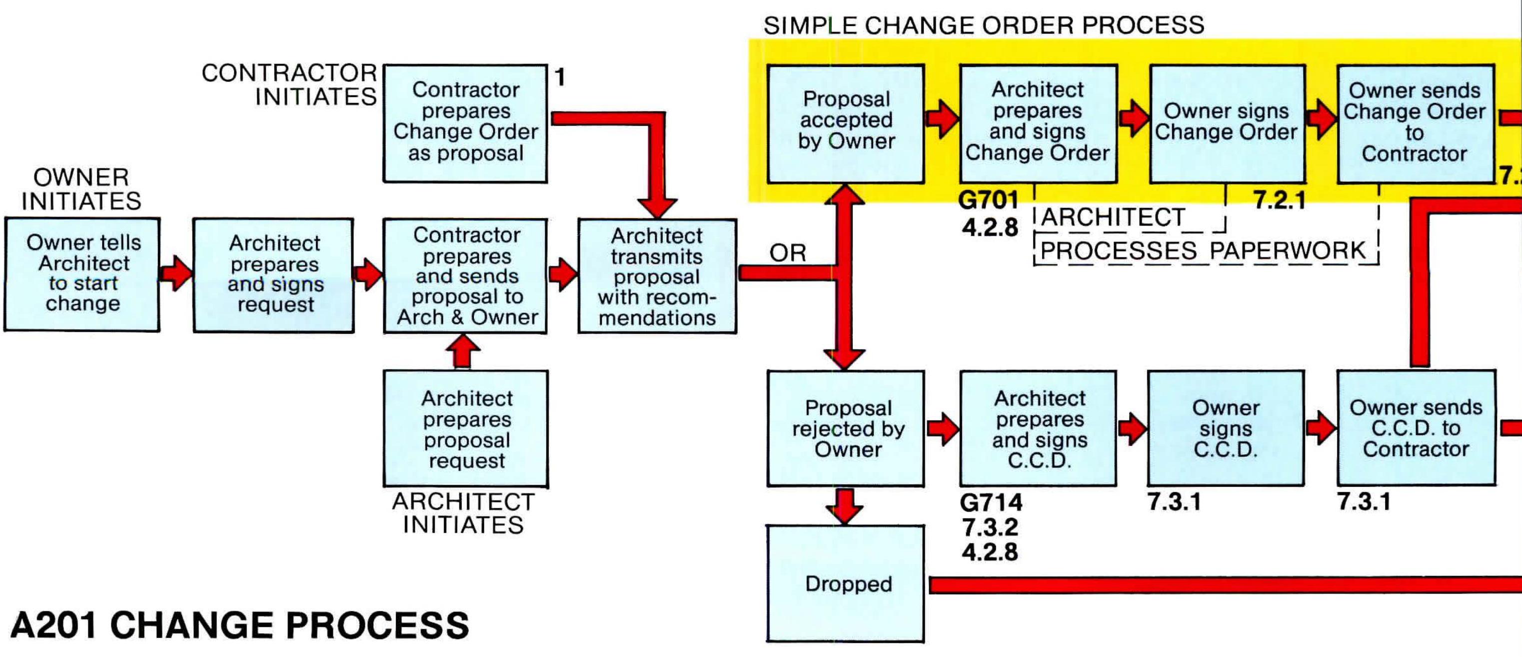
The unwary architect might be caught overcertifying payment under G702 if the amount for the CCD work is not an "authorized adjustment" to the total contract sum. Only amounts authorized under the contract sum should be certified by the architect. To obtain an authorized adjustment, the architect must have the *owner's* agreement. This process will take some careful watching by the architect.

In the 1970 edition of A201, the architect was allowed to make changes relating to scope, time, and price when authorized in advance and in writing by the owner. European forms of construction contracts often go further and allow the architect blanket power to authorize "variation." Recognizing the potential for abuse (and exposure to liability) associated with such power, the AIA took this power away from the architect in the 1976 edition of A201. Under the 1976 and 1987 editions, the architect may make only "minor changes" that do not affect the time or cost of the construction contract (Subparagraph 7.4.1).

The administrative burden to ensure that the change process goes according to the construction contract lies with the architect. A201 says, "The architect will prepare Change Orders and Construction Change Directives . . ." It is up to the architect to control the process and, when necessary, to develop further implementing procedures. A201 provides a basic framework for the change process; it does not detail a step-by-step approach. Because of the varying circumstances of each project, these must be developed on a project-by-project basis by the architect in consultation with the owner and contractor.

The 1987 edition of A201 was revised purposefully to prevent the contractor and the owner from taking advantage of each other under the change order procedure, first by adding provisions that would steer the parties toward mutual agreement about changes, whenever possible, as pointed out above. Second, when mutual agreement cannot be achieved, then procedures are spelled out for the architect's determination of the fair price and time adjustments—and, if that fails, for determination by a detailed claims procedure set out in Article 4.

Under the new A201, *all* notices of claims are required to be



A201 CHANGE PROCESS

made in writing to the architect within 21 days after the claim arises or is first recognized, whichever is later. On occasion, a contractor will prepare and send a G701 (change order form) to the architect for an adjustment to the price or the time. Another practice is for the contractor to write or type on the form a statement reserving the contractor's right to make a later claim. Whether these are notices of a claim depends on the circumstances. Because neither situation is framed in such a manner that could be an unequivocal "notice" of a claim, the contractor may risk waiving a claim if the G701 is deemed not to be timely notice.

The prudent practice now under the new General Conditions would be for the contractor to file a separate notice of claim with the architect rather than to rely upon some statement on the construction change directive to suffice. Some commentators have been confused by the new time periods involved and have interpreted the provisions as fixing a time period (as little as three days, according to some) within which the architect must render a decision on the claim or other interpretation. This is not correct. The architect has an indefinite period within which to make an interpretation, and neither the owner nor the contractor may press for an interpretation by claiming a delay until at least 15 days have passed. However, the architect is subject to the requirement to take "preliminary action" within 10 days after a claim is made in writing. The architect has five options under Subparagraph 4.4.1, the simplest being to request additional information from the owner and contractor. Once preliminary action is taken, the architect has an indefinite amount of time to decide the claim.

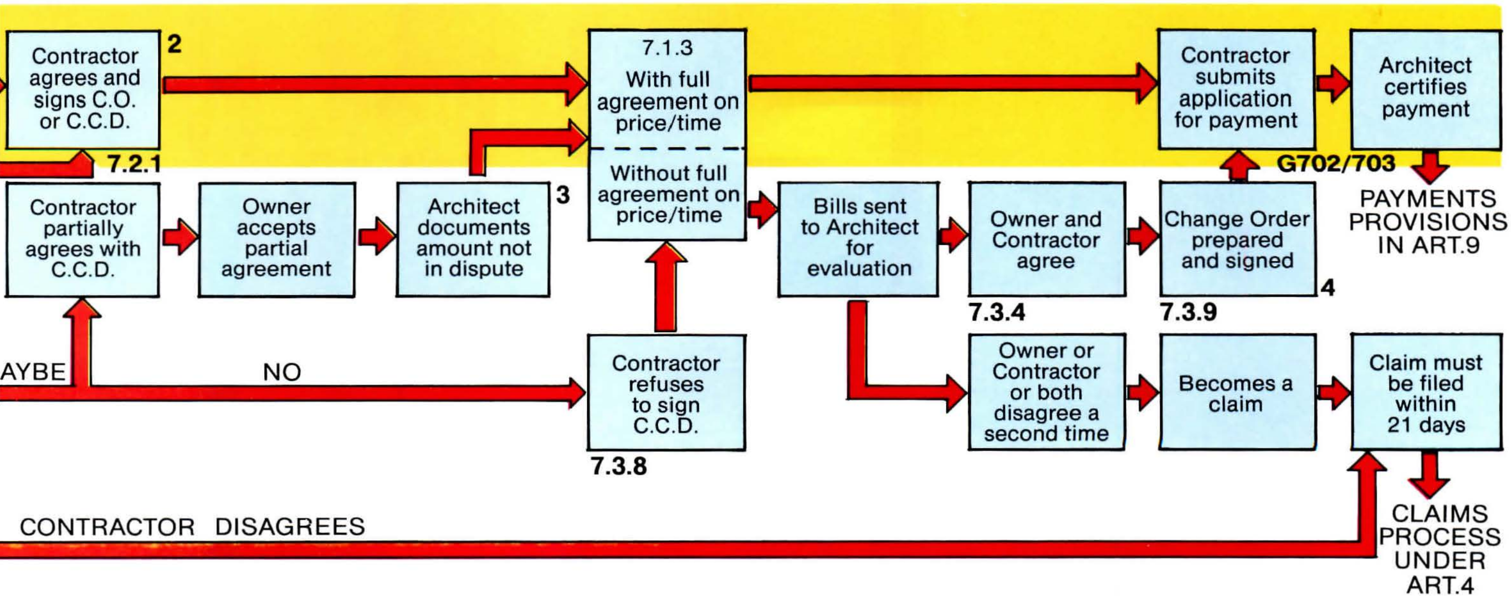
This arrangement is fairly complex, but the reasoning behind it is fairly straightforward. Recognizing that the courts have consistently made the architect's decision a condition precedent to arbitration, the drafters nevertheless wished to prevent the architect's inaction from hindering the parties in proceeding to arbitration. At the same time, they wished to give the architect adequate time to render a decision. Therefore, a series of exceptions was included under Subparagraph 4.5.4 to allow the parties to go to arbitration after a reasonable waiting period, which varies according to the circumstances. If, for example, the position of architect is vacant—as it may be under a worst-case scenario—the parties can proceed directly to arbitration. On the other hand, if the problem is simply a delay, the parties are required to wait 45 days before invoking arbitration. Other periods of time are provided to deal with intermediate situations. In a sense, a series of time locks is provided in order to maintain the normal procedure but allow it to be overridden in the event that it breaks down.

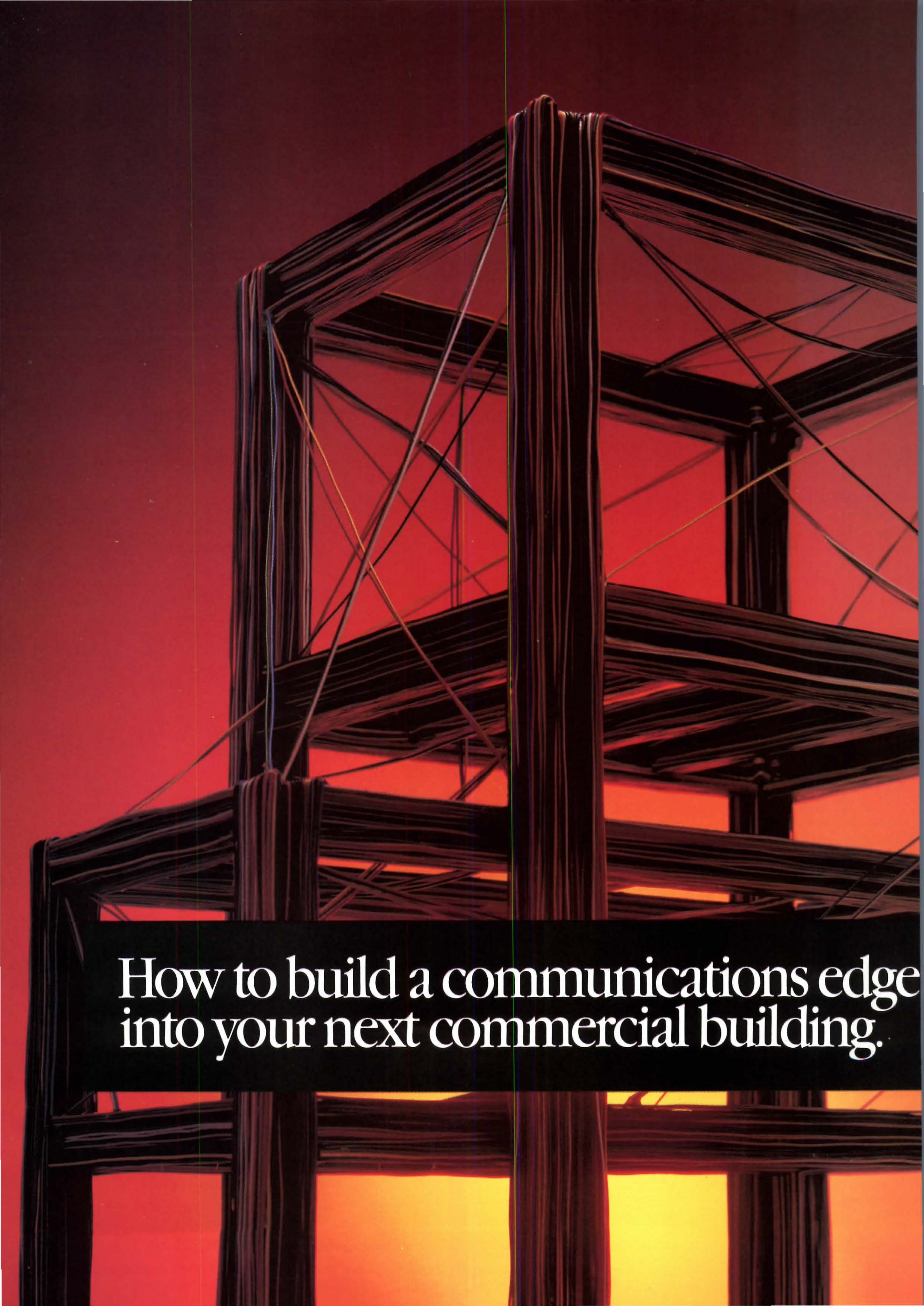
The change process and the claims process are somewhat more complex under the new General Conditions. Both processes are set out in greater detail, an improvement that could be made only at the cost of greater complexity. This is not to say that the owner, architect, and contractor are going to be led by the hand. Further details will need to be worked out on any specific project, and any architect who agrees to administer a construction contract should think ahead and try to develop strategies based on the more common scenarios normally encountered in the course of construction.

Finally, it may be asked, "Why should the architect get involved at all? Why shouldn't the owner and contractor handle the change process and any claims that arise from it?" Given the liability burdens and insurance costs the architectural profession bears, it seems like a reasonable question. An answer—recognizing that "*the* answer" doesn't exist—is that A201 can be modified through the use of supplementary conditions to accomplish this. For those who may need guidance in this matter, AIA is contemplating publication of model supplementary conditions along just these lines.

The fact remains, though, that removing the architect from the changes and claims processes will also reduce the architect's ability to influence the construction process. Some may gain from that, but the public would certainly be better protected with the architect involved as professional adviser on change orders. Catastrophe would result if, for example, an owner unilaterally ordered a change in column spacing. The contractor might prevent this, but only if he or she recognized a dangerous increase in loads.

As for architects themselves, the question now is the same as it has been many times in the past: Where do they want to be—in the driver's seat or in the back seat? □




How to build a communications edge
into your next commercial building.

AT&T's Premises Distribution System: A single wiring system that meets all your clients' communications needs.

Once, setting up the right building communications system was simple—all you had to worry about was wiring for telephones.

Today's building environment is far more complex, requiring a variety of voice, data and image systems, often from a variety of vendors. Each supported by an individual wiring scheme designed for it alone. Making it difficult to meet the communications needs of each of your clients.

Well, now AT&T can make the installation, expansion, and integration of communications systems simple again. With a complete wiring system that provides connectivity for the various types of equipment your tenants may wish to use: the AT&T Premises Distribution System (PDS).

A lot to take advantage of.
AT&T's PDS incorporates every necessary element—from the cabling plan to the system administration products.

All of which results in a number of distinct advantages.

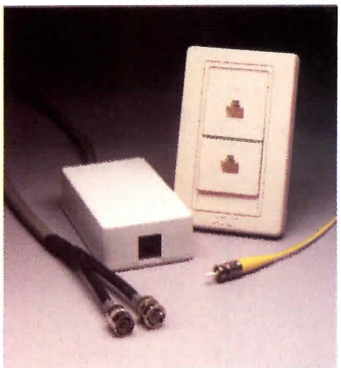
The advantage of accountability—PDS is backed by a firm AT&T commitment to provide connectivity with virtually every major vendor's equipment, including AT&T's.

The advantage of flexibility—PDS makes it easy to use the best product for each communications function. Your tenants are not locked into a single vendor's technology. And PDS supports voice and data transmission, as well as image, digitized video, and other forms of communication.

The advantage of expandability—PDS allows users to connect equipment through universal jacks that fit standard wall outlets.

The "AT&T" advantage.
PDS is backed by a comprehensive range of consulting, design, engineering, and service support to ensure the system meets current and future communications needs. Our Application Assurance Program is a commitment that your PDS will support certified applications for a full five years.

For more information, call AT&T at 1 800 372-2447, or mail the coupon. Or contact your authorized PDS distributor.



AT&T's PDS is a comprehensive system of basic components, from inside wire (both copper and fiber), to electronic apparatus and support services.

AT&T Network Systems, ARC 2/88
P.O. Box 1278, Morristown, NJ 07960-1278.
Please send me more information about the AT&T Premises Distribution System.

Name ______________________________

Title ______________________________

Company ______________________________

Address ______________________________

City ______________ State __________ Zip __________

Phone ( )______________________________

AT&T
The right choice.

Circle 84 on information card

Wood: Holding Its Place Through Decades of Change

Second in a series on basic materials.
By Forrest Wilson

Photographs courtesy of Western Wood Products Association

Wood is our oldest building material. It is a living, growing medium, warm to the touch, with boundless variation. No matter how they are machined, no two pieces of wood are ever absolutely identical. Wood can be worked with simple tools to make simple buildings or engineered to form great structures. Nowhere is humankind's control over nature more evident or more personal than in wood technology.

The history of wood is the history of how each age has chosen to work it, and the primary woodworking tool has traditionally been the saw. The "fire saw," or sawing thong, dates from the domestication of fire. There were flint saws during the early Stone Age, and saws of black obsidian were used by Sumerian craftsmen during the Bronze Age.

Raking saw teeth to cut on the pull stroke for ripping, setting the teeth to make the cutting path wider, and tapering the blade from front to back to reduce pinching action were inventions of unknown genius before recorded history. Eight-foot-long Egyptian metal saws for cutting wood and stone date from 4000 B.C.

The first water-powered mills appeared in A.D. 1200, and the rise of wood-related trades in the Middle Ages deforested millions of acres. Wood quickly became a rare, precious material in Europe. Wood was used in the building industry for timber-framed houses, water mills and windmills, bridges, and military installations. Wooden vats and casks held wine. There were wooden ships, and all medieval machinery, such as weavers' looms, were wood. Tanners and rope makers used the bark of trees. The glass industry fueled its furnaces with wood and the iron industry needed charcoal for its forges. By 1300, the forests of France covered 2 million fewer acres than they do today.

Wood was so expensive that poor families could not afford to buy a coffin for their dead. They rented one and, after the funeral, the undertaker opened the coffin, removed the corpse, and kept the coffin to use again.

It is no wonder, then, that in North America, the abundance of wood, even more than gold, fulfilled the promises of New World riches. The first pilgrims sent back a load of wood shakes on the Mayflower's return voyage to help defray the cost of their passage, and by 1624 they were operating a sawmill. Once again there was a reason to develop tools for working wood—the circular saw was patented in England in 1777 and first used commercially in 1781. Band saws appeared in 1808.

Wood has always had a special meaning for Americans. By 1900, the American sawmill industry was well advanced compared with other industries. Lumber was manufactured quickly and accurately and, in tandem with mass-produced cut nails, resulted in the most uniquely American of our structures, the New England house, the balloon frame, and later the platform frame.

Despite this century's embrace of new materials and technologies, wood has managed to hold its place as a major construction material. The following brief history traces the major developments in the wood industry over the last 75 years.

1913-1920: Vast cullings

Logging traditionally has been slow, ponderous work. For centuries, hand-cut trees are hauled by oxen and transported by river. Then, in the 1920s, steam power lightens the work of man and animal. Steam-powered "donkeys" lift logs by cable to landings, where they are loaded on trains. This is a capital-intensive operation that requires the cutting of vast acreages of forest to justify costs.

Research and development. The U.S. Department of Agriculture establishes the Forest Product Laboratory (FPL) in 1910 in Madison, Wis. Its mission is to increase the serviceability of wood products, develop new uses, improve existing methods of manufacture, and enhance the quality and usefulness of all wood products. The history of the FPL parallels the history of wood and building technology in America.

Among FPL's first tasks is research on the quality of wood seasoned in the "dry kiln." It also analyzes preservatives for railroad ties, telegraph poles, and mine timbers and examines the effects of preservatives on wood strength and prevention of the growth of wood-destroying fungi. It diagnoses and classifies decay, and it researches wood's natural fire resistance.

During World War I, the need for plywood with reliable moisture-resistant adhesives prompts research on veneer production, water-resistant glues, and bonding techniques for more efficient plywood production.

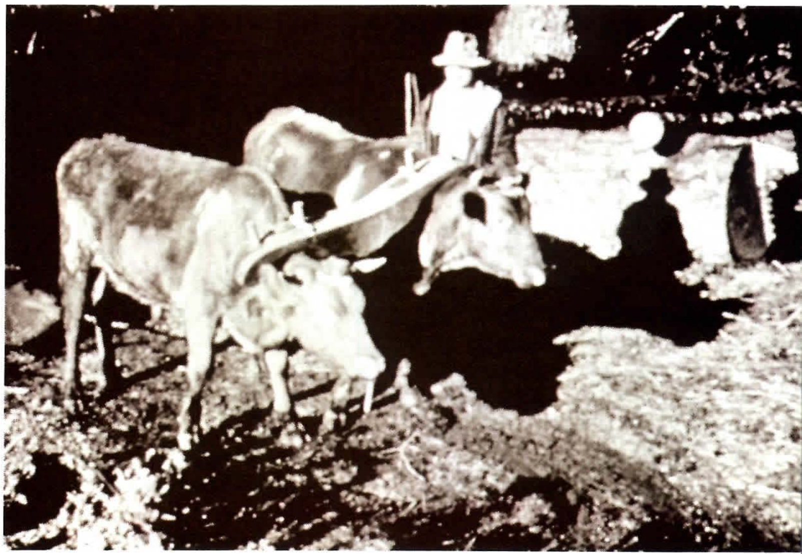
1920-1930: Product standards

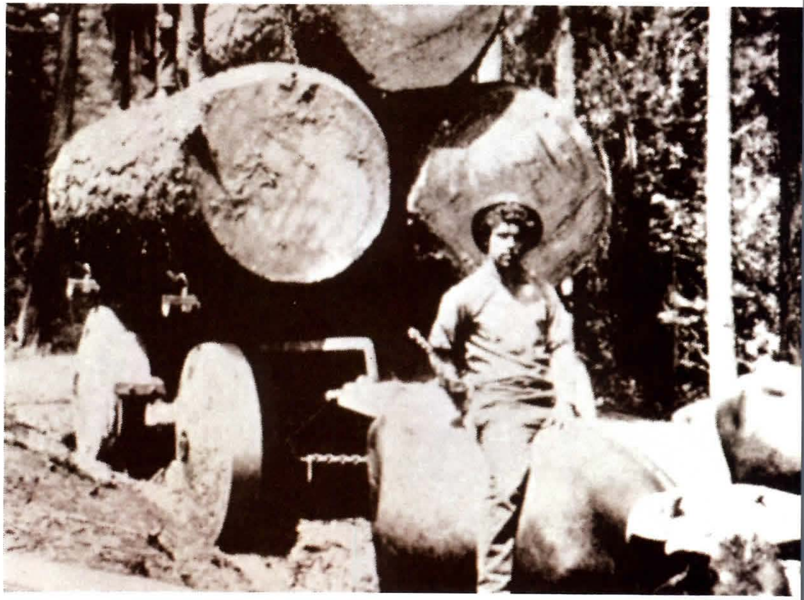
Gas-powered engines come to the woods and end the steam era. Logging trucks replace locomotives and steam donkeys. Gas-powered saws replace handsaws; trees are cut more quickly and efficiently.

The furniture industry improves steaming and bending processes.

The fragmented lumber industry unites in 1924, when the American Lumber Standards Committee establishes voluntary product standards.

Research and development. Equipment for testing large struc-





tural members, wooden columns, and bridges is introduced.

FPL begins "economic investigations" of timber depletion, prices, exports, industry demands, and consumption. It advocates standardization of lumber sizes, grades, specifications, and nomenclature to reduce waste. Researchers formalize information on wood moisture, and the "fan kiln" comes into use.

Research leading to the development of the electrical-resistance moisture meter begins, and results in industry standards for "equilibrium moisture contents" (EMCs).

1930-1940: Improved transportation

From the early 1880s to 1930, lumber transportation, except for water shipments, has been limited, and consequently a high percentage of lumber sales has been drawn from regional wood supplies. This begins to change during the 1930s.

The stressed-skin principle of wood construction is developed. Prefabricated wall units and improved moisture barriers are introduced.

Research and development. FPL investigates design of laminated arches, publishes the first edition of the *Wood Handbook,* conducts a nationwide survey of forest lands, introduces chemical baths to speed drying, and distributes data on the influence of moisture on wood strength.

1940-1950: Westward ho!

From 1880 to after World War II, little change has occurred in the milling industry or its equipment. Most of the machinery used at the turn of the century is still in operation in 1950. Sawing accuracy deteriorates, and stumpage (uncut marketable timber) is cheap and plentiful.

The wood industry in the western states has grown rapidly from 1930 to 1945, at which time the West becomes the nation's foremost timber supply region. Wood production in the South declines, and the western Canadian wood industry begins to affect the market.

Steel shortages during the war encourage the exploration and acceptance of wood industrial structures. Factory panelization reaches the market.

Research and development. Researchers conduct experiments on "sandwich" construction for aircraft and measure strength of laminated ship timbers and military structures. Concurrently, architects and engineers pioneer use of laminated arches and long-span beams. Adhesive development brings new wood-plastic composites for airplane propellers, flooring, carrier decking, and connectors. The war prompts chemical seasoning of Douglas fir for transporting war materials and methods of drying lumber without loss of strength for use in gliders and airplanes.

Builders use sandwich-construction housing components, with lightweight cores of wood and paper honeycomb laminated to thin materials. A new family of products composed of wood fibers, particles, or chips reaches the market.

A reappraisal of U.S. forest resources following the war indicates timber shortages and changes in use due to second-growth timber, leading to the need to improve sawing practices.

1950-1960: The industry mechanizes

For the first 50 years of this century, Douglas fir and ponderosa pine have been the American species used in greatest quantity, except in Alaska and British Columbia, where a mix of Douglas fir, western red cedar, and hemlock make up the bulk of use. In 1944, stumpage prices for Douglas fir and ponderosa pine begin to rise rapidly, reaching a 340 percent increase in 1954. This price increase causes a shift to other types of wood, and the lion's share of wood use includes white fir, hemlock, spruce, and lodgepole pine. Redwood also is accepted.

A steady rise in the cost of labor after World War II forces mechanization, with dramatic results. From production of 1,000 to 4,000 board-feet per person per day, production rises to 25,000 or more board-feet per person per day. Nevertheless, lumber continues to be cut inaccurately and wastefully. The timber boom ends. More efficient conversion methods are introduced with digital control units and small computers.

Development of toothed metal connector plates creates the wood building component industry, which gives site builders the ability to compete with factory panelizers.

Research and development. Research indicates light framing will meet performance standards. Increased interest in hazards mitigation prompts studies of earthquake and tornado damage to wood structures.

On-site studies investigate treatment for decay and fungus growth. Electronic tools, microscopy, and radioactive assay systems become an integral part of the wood researcher's repertoire. Researchers study more accurate saw operation with less power, as well as the effects of drying on internal lumber stresses.

1960-1970: The platform frame

Balloon and helicopter logging permit access to previously inaccessible forest areas. The West is now the American "king of lumber," but Canada becomes a contender, and the South begins an upswing as southern forests grow back. Nonetheless, stumpage prices rise dramatically.

Lumber recovery of raw material has remained basically unchanged from the late 1920s. In response to rising timber costs, mills move to increase the amount of lumber that can be cut from a single log. Consequently, residues are used for pulp and paper, chipboard, and energy production.

From 1965 through 1970, design values for all commercial softwood species are established. More sophisticated testing methods, precise engineering, and high-tech products such as machine-stress-rated (MSR) lumber are introduced.

After World War II, platform frame construction for tract housing satisfies the housing boom, with platform framing used in 95 percent of housing.

From 1946 to 1969, rail shipments dominate transportation as mills reach far beyond regional markets in addition to servicing their immediate regions. The exception is Canada, which ships to all regions of the United States. The transit wholesaler, who buys carloads of lumber and sells it in transit in the East and Midwest, emerges and then disappears during this period.

Channel bypassing, by which the mill sells directly to the retailer, bypassing the wholesaler, appears. Retailers join together in retail co-ops to buy a greater variety and volume of products at competitive prices.

Research and development. Development of the southern pine plywood industry prompts research to convert underutilized species for plywood. Other research topics include structural components from parallel-laminated, rotary-cut veneer; standards for laminated-veneer lumber; built-up structural members for railroad ties and bridge decking; saw-line placement for greatest lumber yield; and drying techniques for use in developing countries.

Photographs courtesy of Western Wood Products Association

1970-1980: High-tech forests

High-tech comes to the forests. Aerial photography, genetically improved trees, helicopter seeding, and computer inventories and simulations find their place in the industry.

Production per worker per hour increases. The last big increase had been in the 1920s when rapid change in technology due to mechanization resulted in fewer workers needed. Then followed a period of relatively level production until the late '70s and early '80s, when recession forces cutbacks and efficiency incentives.

Mills cut smaller logs because big timber is running out. Smaller logs have lower recovery rates—that is, they yield less usable lumber per volume. Computerized sawmilling increases in the late '70s and early '80s, and fewer mills with fewer workers produce record amounts of lumber.

A primary industry takes logs and converts them to basic products. Secondary industries take these products and manufacture specialty products, such as windows, doors, sashes, furniture, etc. Where lumbering traditionally was the primary industry, new primary industries of pulp, paper, and plywood appear. These, which formerly were "secondary industries," grow faster than the primary industry of solid-sawn lumber.

The plywood industry competes for logs of higher quality. The lumber industry, which in theory uses middle-grade logs, competes with the paper industry for lower-quality logs. The result is fewer clear Douglas fir and hemlock-fir products. Though western plywood is not made of pine, southern plywood is all pine. Because more plywood than lumber can be made from a log, the production scale tips toward plywood.

Product standards are revised, and a national grade rule for softwood dimension lumber two to four inches thick results in a uniform standard throughout North America.

The metal-connected, flat-chord floor truss is introduced. Guidelines for thermal insulation, moisture and noise control, and renovation and remodeling techniques emerge. Strength, speed, and economy are achieved with prefabricated, truss-framed systems for framing small buildings.

Research and development. Researchers explore methods to preserve and protect wood by treatments with reduced toxicity and greater selectivity. Fundamental studies commence on interruption of the decay cycle and development of a specific, naturally occurring toxin to control termites.

Chemicals are bonded to wood to improve dimensional stability resistance to fire, decay, and ultraviolet light. Researchers also study the economic feasibility of new or improved products and processes to transfer new technologies into commercial use and assess new sawing methods, lumber defect detection, paper production, and house building systems.

1980-1988: Environmental assault

The timberlands of the West are cut over and nearly depleted. Federal lands come under more pressure for higher cuts. Industry and environmental interests conflict as the environmental movement gains legal power to challenge federal forest decisions.

Grading and use of lumber now encompass five categories: light framing, structural light framing, structural joists, planks, and studs.

Wholesalers specialize by product type and reduce product offerings. Channel bypassing increases. Deregulation of transportation brings in reloading and distribution centers—huge operations that buy large volumes of wood and break them down into manageable packages for resale to retailers.

Despite apparent advantages, MSR is not widely accepted. About 1 percent of softwood lumber production is machine stress rated.

Research and development. Research to determine strength properties of wood members and systems continues. Other areas of experimentation include lumber grades, effects of environmental conditions, loads, construction, fasteners, and treatments.

Research tools and techniques advance. Building components are mathematically modeled and analyzed to assess and meet performance standards. A test frame subjects an entire house to realistic stresses to measure the performance of materials and construction. Computers model structural behavior, moisture movement, and performance of wood members in fire exposure. Modeling and optimizing the physical processes of compacting and curing wood composites further refine an innovative compaction process called steam injection pressing. Researchers classify and improve the dimensional stability properties of these composites.

Wood researchers also study intensively the design and efficiency of solar kilns. Other techniques under scrutiny are press and vacuum drying and benefits in speed and dehumidification drying for smaller operators.

The Future: New products and technologies

Stabilizing wood under ultraviolet light and wood stability under moisture conditions for finish application and outdoor use will be studied. Research into alternative adhesive systems and basic information on creep and duration-of-load properties of wood composites will continue.

Development of new adhesives and new manufacturing technologies to improve wood utilization is planned. Work with glued joints, shaped sections, and implant application of preservatives and fire retardants will continue. Problems of formaldehyde emissions and the development of adhesives from renewable resources will be solved.

Future work in chemical modification of wood will define the reactions occurring and characterize the treated wood to help find optimum uses.

Future research will be shaped by the characterization of the chemical, physical, and mechanical properties of adhesives and wood elements during and after bonding, and of bonded structures in service. Research will continue on logging and manufacturing wastes.

Basic mechanics of the sawing process, including wood anatomy, cutting forces, and saw-operating conditions enabling sawmills better to use each tree, will receive further scrutiny.

Computers will continue to play increasingly sophisticated roles in improving the efficiency of milling decisions, log moving, lumber production, and planning. New tools will be developed, such as lasers, to manufacture lumber with reduced waste.

Acoustic emission technology and other sensitive sophisticated instruments will measure wood's response to drying. Computers will correlate critical drying stresses detected by acoustic emissions to kiln control as an early warning signal to prevent drying degradation.

The direction of technological change will be toward development of new products that allow complete log usage begun in waferboard and oriented-strand board products, which use scraps and "junk wood."

Wood systems available today

Today, architects need to know:
• Traditional wood frame construction system with studs and joists for short spans and maximum economy; stick-built buildings framed on site.
• Pre-assembled wall panels designed as tilt-up systems.
• Panelized roof systems that can be used when speed of construction is a consideration.
• Combining wood frame with heavy timber to create a more flexible system. Machine-stress-rated lumber can be a part of

these systems when high strength is required. MSR material frequently is used for top and bottom chords of metal open-web joists. The greater depth of these joists offers a greater strength for long spans, as well as more space for mechanical equipment or ductwork.

• Parallel-chord trusses offer advantages over MSR wood trusses. Plywood and waferboard web joists are examples of combinations replacing solid-sawn products.

• Phenolic glue makes wood I-beams possible. Glued laminated ("glu-lam") lumber—several layers of wood glued together, is used where dimensional stability and greater span are required. Glu-lam may be combined with lumber and plywood roof panels for a panelized roof system. The 2x4s and plywood are pre-assembled on the ground and lifted in place with a crane.

• Pressure-preservative-treated lumber is not new, but chemical treatment recently has improved. Treated lumber is increasingly being used for outdoor applications such as decks, outdoor rooms, and fences.

• Fire-retardant-treated wood is gaining popularity where codes require noncombustible materials.

• Plywood and other structural panels have been replacing a large portion of the solid-sawn lumber market in roofing, flooring, and sheathing materials. Plywood use has grown steadily since its introduction in the 1940s.

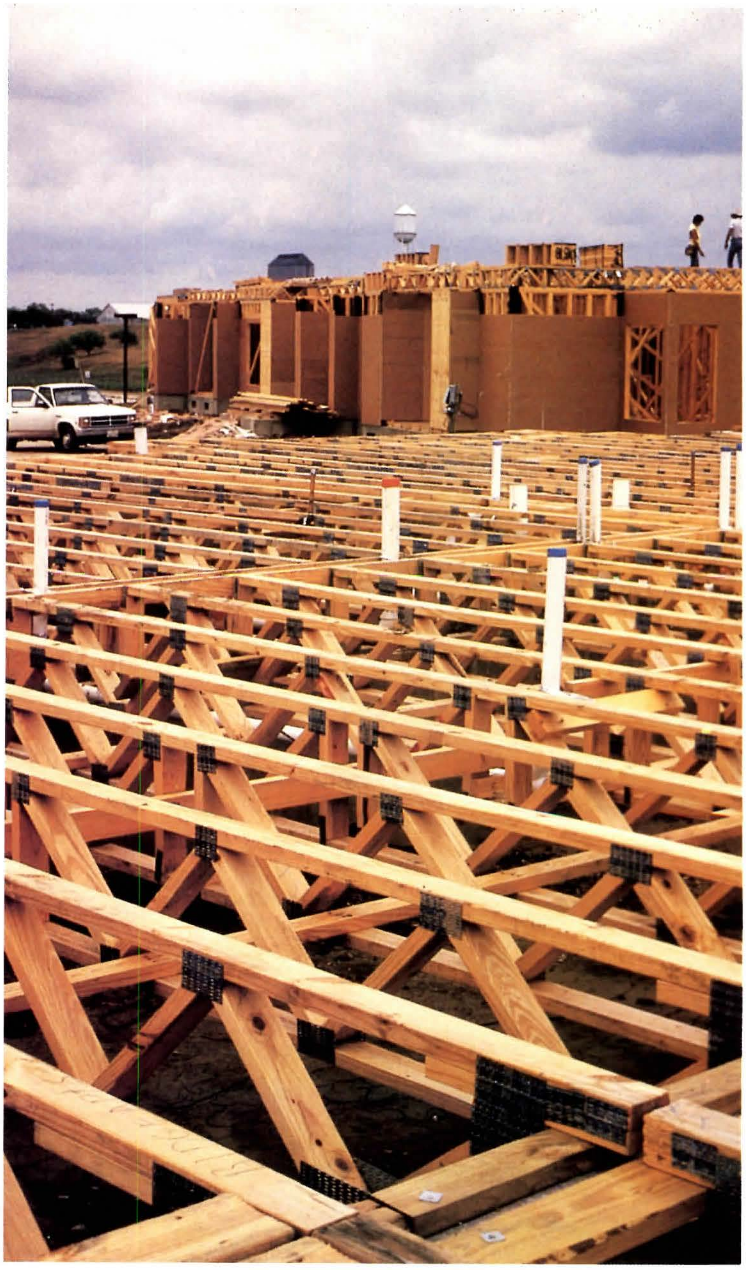
Once again, wood is a rare and valued commodity, and, fortunately, research and technology will continue to extend its uses. The most publicized development is "value-enhanced" wood products—the reconstitution of formerly discarded wooden parts and species into a sausagelike mass held together with strong mastics.

The problem of fire resistance for value-enhanced wood has yet to be resolved. In a fire, its toxicity debilitates firefighters, and the metal nailing plates holding the wood together char so rapidly that firefighters are dumped into the flames (see June '87, page 99).

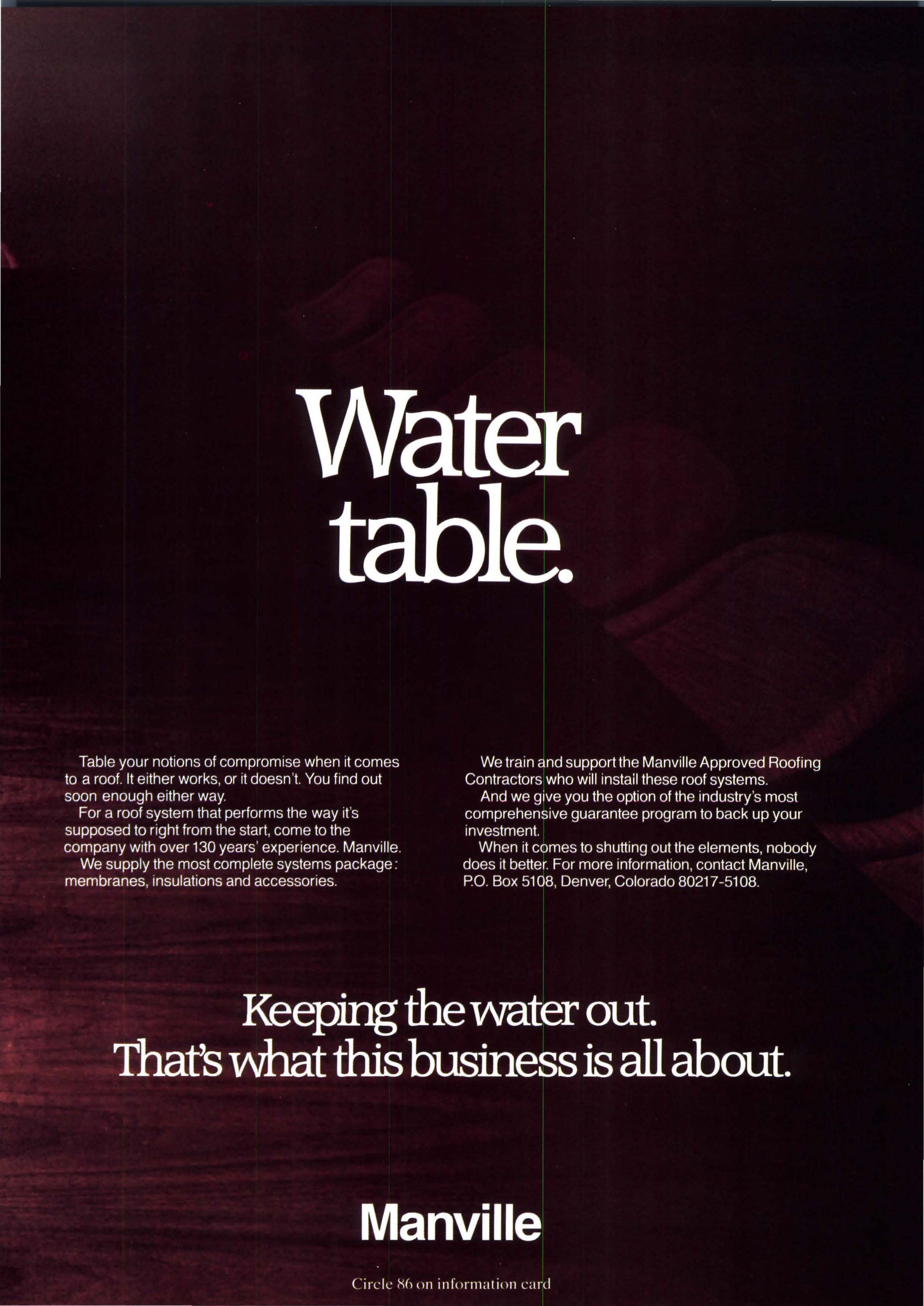
Automation has reduced labor costs and increased productivity. Computer analysis has improved logging and lays out the most economic saw-cutting patterns. Wood has been extended below grade to foundations and encloses floor plenums. The "truss joist," or wooden I-beam, is now common. Prefabricated roof trusses are combined with prefabricated floor trusses, and the entire structure is held together by a variety of metal fasteners.

Engineering skill and research has come to the small wooden structure. The "Truss Framed System" was developed and patented by the Forest Products Laboratory, and the patent has been placed in the public domain. Less lumber, time, and labor are required—in a single day, houses are erected and closed in. Engineered structural members are no longer cut at random using commonsense rules. The prefabricated truss industry now extends to the entire house. Houses are more assembled than built, and house carpenters are as useful on the construction site as slide rules are on the developer's desk.

The author especially thanks Pete Kent of Western Wood Products. Thanks also are due to the American Wood Preservers Institute, Wood Products Promotional Council, American Plywood Association, National Forest Products Association, Southern Forest Products Association, NAHB Research Foundation, Forest Products Laboratory of the Forest Service, U.S. Department of Agriculture, American Institute of Timber Construction, and others. □



Photographs courtesy of Western Wood Products Association


Water table.
Table your notions of compromise when it comes to a roof. It either works, or it doesn't. You find out soon enough either way.
For a roof system that performs the way it's supposed to right from the start, come to the company with over 130 years' experience. Manville.
We supply the most complete systems package: membranes, insulations and accessories.
We train and support the Manville Approved Roofing Contractors who will install these roof systems.
And we give you the option of the industry's most comprehensive guarantee program to back up your investment.
When it comes to shutting out the elements, nobody does it better. For more information, contact Manville, P.O. Box 5108, Denver, Colorado 80217-5108.
Keeping the water out.
That's what this business is all about.
Manville
Circle 86 on information card

'New Faces' in Medium-Priced CADD

An evaluation of five. By Oliver Witte

Choices in medium-priced computer-aided design keep getting more diverse. Of the dozens of new faces that have appeared in the past year or two, we have chosen the following five for evaluation:

- Arris by Sigma Design, Englewood, Colo.
- Drawbase by Skok Systems, Cambridge, Mass.
- Fastcad by Evolution Computing, Tempe, Ariz.
- Microstation by Intergraph, Huntsville, Ala.
- Ultracadd Plus by Maxam Technologies, Rockville, Md.

All these new programs claim to be better than Autocad, as well as Cadvance, Datacad, Drafix, Megacadd, Personal Architect, Point Line, and Versacad—the programs that were reviewed here in February 1987 and that remain fierce competitors.

To find out which of the group are most likely to challenge the leaders, ARCHITECTURE assembled five teams of evaluators, each composed of two registered architects from different firms. All were selected from the Chicago area to enable them to exchange information and impressions conveniently. All had at least some previous experience with CADD.

Each evaluator agreed to use his assigned program professionally and to report on its suitability for use by his firm. The teams then met on Nov. 30, 1987, at the Illinois Institute of Technology for formal presentations by each vendor and for a private roundtable discussion. Written reports by the teams follow this introduction, and a table adjoining this article compares the programs' objective characteristics. Another table summarizes the judgments of the evaluators. Caution is advised in interpreting the rankings—the pertinence of an opinion depends on the extent to which the reader's needs match those of the evaluator.

For example, John C. Voosen, AIA, thought Fastcad was the best of the five programs. Paul J. Zinni, AIA, ranked it last. The divergence says as much about the needs of the two architects and the differences between their practices as it does about the program.

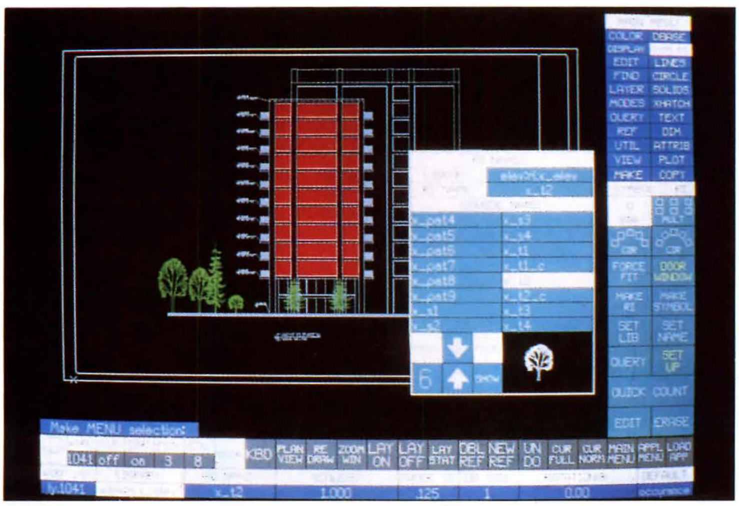
The new programs selected for evaluation have significant 2D drafting capabilities. All five programs run on personal computers based on the Intel 80286 or 80386 microprocessor. Later this year, we will publish a report on CADD systems with 3D capabilities, a comparative evaluation of CADD programs written for the Apple Macintosh, and an update on the older affordable CADD programs.

"Affordable," for this series of reports, has been loosely defined as capable of running on a personal computer and costing, on the average, roughly $3,000. The prices range from Drafix, at less than $500, to Point Line, which used to cost $12,500 complete. The software reviewed here, with all available options, is priced from $2,295 (Fastcad) to $9,000 (Arris). However, the version of Arris that was evaluated and demonstrated is priced at $6,500. Manufacturers' addresses are listed in the Products section, on page 140.

Arris

Arris is among the first Xenix-based CADD programs for microcomputers. Formerly called CADD Solutions, Arris is distinguished from most other computer-aided design programs by its single-minded focus on architecture and building design. While other programs such as Microstation and Fastcad appear to have excellent general drafting capabilities, Arris's specialization provides the architect with unique capabilities.

Arris really is a family of software programs organized around a common data base structure developed by Sigma Design from its earlier turnkey system for minicomputers. The basic building design and drafting package is required to use any of the Arris software. Although each module adds capabilities, even the basic program can create and manipulate 2D and 3D drawings, text, and macros. The modules and their prices: building design and drafting, $3,000; architectural drafting, $2,000; modeling and rendering, $1,500; space design, $700; Sirgen (data base), $1,000; and Sigmac (macro compiler), $1,000. Most customers



Arris by Sigma Design allows changing from 2D drawing to 3D modeling and rendering. All commands work for both 2D and 3D.

buy only the first three. Although the program is protected with a hardware lock, discounts of 10 percent to 55 percent are provided for purchases of two or more programs.

Space design provides architects with automated, graphic techniques for analyzing space requirements and affinity relationships and for developing bubble, stacking, and blocking diagrams. A firm specializing in facility space planning might find this module not powerful enough, but it's more than adequate for architects. Sirgen and Sigmac were not evaluated.

One example of Arris's capabilities is called "smart walls" and is included in the architectural module. "Smart walls" looks like the double line drawing technique in other architectural CADD programs, but it incorporates data that makes it easy to prepare cost estimates. The information includes:

- Materials, sizes, and hardware.
- Construction information that can appear on reports and in partition bubbles on the drawing.
- Dimensional relationships to adjoining construction.
- Parametric data that allows doors and windows to be inserted and edited with dynamic control of their position, swing, bubble, and open/close display. The architect could insert a generic door early in the process and later specify hardware.

The drawing logic of "smart walls" is quite different from that of programs like Autocad.

Among our most effective uses of Arris have been 3D modeling and rendering. The Arris data base is inherently 3D, and all commands work in both 2D and 3D. In fact, the only difference between 2D and 3D is how you look at your drawing. Unlike other programs, Arris's 3D capability is inherent in the basic program, not offered separately as an option.

Any drawing can be looked at in 3D by changing the viewpoint from plan view (2D) to elevation, isometric, or perspective. Wire-frame 3D is included in the basic module; so is background printing, plotting, text editing, optional multi-user operation, password protection, and excellent translators for DXF, IGES, and ASCII file protocols. We tried the DXF translator and were successful in importing an Autocad drawing.

The modeling and rendering module provides more power:

- Symbols such as cars and people to add scale to a model.
- "Smart wall" extrusions to create floor plans automatically with 3D walls, doors, and windows.
- Advanced tools for adding shading, shadowing, transparency, and dithering to 3D models. The operator can choose up to six light sources, plus ambient light. None of the other programs evaluated here makes it so easy to study light and shadow.
- Sophisticated color mixing and editing.

Arris has managed to provide the benefits of screen menus without their usual detractions. The key benefit is "heads-up drawing," with the eye always on the screen.

The disadvantage has been that the screen can hold only a few menu selections at a time without encroaching excessively on the area needed for drawing. To avoid having to sort through multiple layers of screen menus to get to a needed command, some vendors make all the commands accessible at one time by putting them on a digitizing tablet. But this method also has its limitations, chiefly the need to be shifting one's gaze between the screen and the digitizer.

Arris allows users to choose up to 15 commands to place on the screen for immediate selection. Still, in a pure production mode, we found that the menu tree structure is inherently slower than the digitizer. Keyboard commands and tablet menus also are available, but they omit some on-screen menu commands.

Arris's big weakness is the initial perception that it will be difficult to learn. This is probably due to its market positioning as a "power user" CADD system, its use of Xenix in lieu of the more popular DOS operating system, its reputation from turnkey days as a command-driven system, and Sigma's earlier in-house training philosophy, which tried to give all users a solid base for macro programming.

The Xenix operating system is a strength because it doesn't have the 640,000-byte limitation that DOS imposes and because it offers a true multitask, multi-user operating environment. It's a hurdle because it's more difficult to learn and use than DOS, it is slow, and it requires a lot of memory.

Non-CADD users do not leave a two-hour Arris demonstration feeling that they can operate the system. Nor is it possible to pick up the manual, turn on the machine, and run the program. We have found that an aggressive implementation plan can avoid most start-up problems. Such a plan, although particularly of benefit to new Arris users, also applies to all new CADD users. Its elements might include:

- Selecting a qualified "power dealer" for installation and training.
- Identifying office or project standards and incorporating them as predrawn items, defaults, or macros.
- Using the system for design and 3D tasks (where really dramatic gains can be made in productivity) without the usual "2D drafting only" break-in period.
- Using the system for real projects as soon as possible. If this is not anticipated, we would recommend an inexpensive CADD system until the firm is ready to support a more aggressive program.

Arris requires at least an IBM-AT type of computer as well as more random-access memory and more hard-disk storage space than most DOS-based programs. Although Sigma officially supports only IBM and Compaq computers, we have been running the program on the Titan, a 386 clone, with only minor hard-disk problems.

Architects who choose Arris commit themselves to a noticeably higher investment of time and money to get the system running and productive. The payback, though, comes when the firm implements the program from design conception through working drawings and project management.

In the roundtable discussion, Raymond L. Harriman, reviewer of the Drawbase program, commented, "Of the programs in this evaluation, only Arris offers features and performance comparable to if not better than Drawbase. Both are somewhat more expensive than generic CADD programs, but they offer more off-the-shelf architectural features that result in longer-term satisfaction and reduce the more considerable costs associated with start-up and training."

Paul Zinni, who reviewed the Fastcad system, added, "In Arris, the user jumps effortlessly between the 2D, 3D, and data base management. Architects willing to put up with the need for a 32-bit computer controlled by the Xenix operating system might want to take a closer look."

—Marshall F. Hjertstedt, AIA, and James S. Lyman, AIA

Mr. Hjertstedt is president of his own four-member A/E firm, which has been using computers for more than three years and Autocad for two years. Mr. Lyman is senior associate with Lester B. Knight & Associates, a 150-member A/E firm specializing in high-technology design. He has been working with CADD since Knight installed a Sigma minicomputer system in 1983. Both firms are in Chicago.

Drawbase

Drawbase has two big advantages: its architectural heritage and its graphically integrated data base that is at once visual, powerful, and easy to use.

Skok Systems, developer of Drawbase, has made our experience with CADD pleasurable. We are architects, not computer programmers. Our focus has always been on the task to be accomplished rather than on the neatness of the tool. At its heart, Drawbase works the way an architect thinks. It is essentially an implementation of Artech, Skok's minicomputer CADD system, for the personal computer. Drawbase contains virtually all of the functions available on the larger system, plus more.

The program is offered in modules, enabling the architecture firm to start inexpensively and let the software grow with the firm. The version we evaluated was Drawbase 5000. Priced at $5,000, it provides 2D, 3D, and data base capabilities. The 2D version is priced at $2,000 and the 3D version at $3,000. The 2D version with data base costs $4,000. A device that attaches to the parallel port at the back of the computer is required to run the program.

Architects starting with Drawbase as their first CADD program will find that it requires little or no customization or add-on work. We found it remarkably easy to learn and use, perhaps because it draws the same way that we are used to drawing manually.

The real strength of Drawbase is in basic day-in, day-out drafting. It contains specific commands to draw parallel line walls and remove the extraneous lines at the intersections, as well as commands to open a wall and insert doors or windows in a single step.

Another useful feature enables drawing entities to be grouped into a set for manipulation. One wall of a room that is too small can be grabbed and pulled out as desired, and the dimension string associated with it will be updated automatically.

A built-in feature permits construction lines or arcs to be placed at a point or by offset angle or tangent to establish basic geometry or to determine a reference point. Intersections formed with either construction lines or real lines can be used as snap points. After the geometry is established, the parts to be kept can be traced over and the rest erased.

During discussions with other CADD evaluators, we heard a lot about modifying menus on the screen or digitizing tablet. Although the Drawbase tablet has room for user-defined functions, most space is given to preset commands. Far from being a shortcoming, this is a major reason why the system is easy to use. Everything needed for drawing is readily available.

On-screen colors permit the architect to designate visual cues for help in drawing. Each layer can be assigned its own color or the drawing can be displayed with each pen type in a different color. Some programs make it necessary to query each object to determine the pen type.

Modeling in 3D is available from the digitizer. A plan can be converted quickly to a wire frame using not only extrusions but also surfaces and oblique planes in space.

Drawbase makes it possible to move around the model quickly. For example, the user can preset the distances—say, five degrees right—and with the touch of a button the viewpoint moves around the model in a circle at five-degree increments.

Hidden lines are removed by exiting the main program and calling up a utility. A similar program can fill and shade the view.

The models can be rotated and zoomed in and out for study, but they cannot be edited. If design changes are called for, the architect must return to the basic program. The process is awkward and needs to be improved.

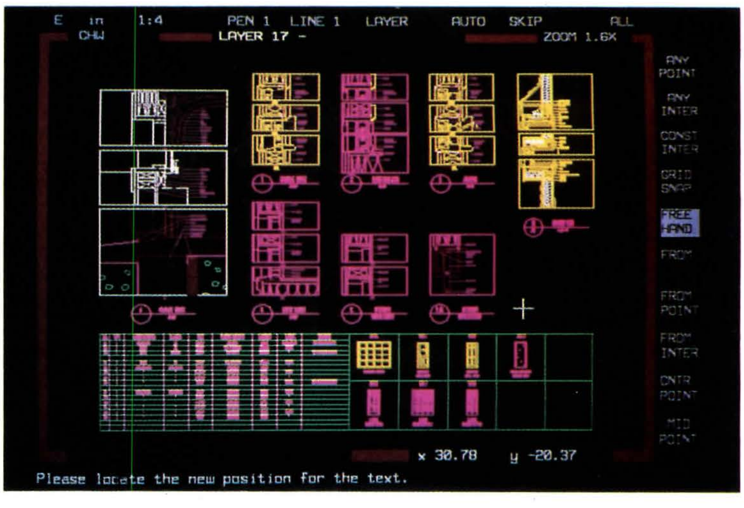
Although we have found the 3D capability to be useful at various stages of project design, it is not as straightforward as 2D drafting. On the other hand, isometric and perspective drawings also are more difficult to do manually. Drawbase can generate multiple perspectives more accurately and faster than is possible by hand.

The uniqueness of Drawbase is the way it handles the data associated with any drawing, but here we must digress. We, as architects, are oriented visually and spatially. Before learning CADD, we had a working knowledge of spread sheets. They are like CADD in that both conceptualize the computer screen as a window to a sheet of paper. While business-oriented persons might think of them in terms of the data they contain, we prefer to think of them spatially and diagrammatically—like a model or drawing.

But wrapping the mind around the concept of a data base is confusing. Even a filing cabinet can be baffling. Nevertheless, even though we are not as comfortable with this part of the program, we have been able to use it productively.

In the two-screen option, one screen contains the drawing and the other contains the data associated with the drawing. At

Skok Systems' Drawbase offers a two-screen option: one screen shows the drawing; the other, related information in text form.



any time, the designer can assign nongraphic information to graphic figures and see both displayed simultaneously. In other words, the two screens display the same information, but one displays it in pictures and the other in words and numbers. If you want to replace all the furniture costing more than X dollars, made by vendor Y, and having covering Z with another option, you can do it on either screen.

In the single-screen option, the user can easily toggle between the two displays at the touch of a button. We recommend dual screens.

Obtaining a bill of materials or some other kind of printed report is not much more complex than getting a printout from a word processor. It's not necessary to learn a data base programming language. The program should be a boon to architects with more than casual data base requirements.

Drawbase also does an exceptional job of space accounting. It tracks wall lengths and areas not only in the active drawing but also from drawings stored on disk. Thus it is possible to compare the current project with past projects and see, for example, if the pricing is in line. Most other programs lack the ability to make comparisons easily with stored drawings.

Furthermore, let's say you are tracking five pieces of information on a symbol or other graphic and you want to add a sixth. In Drawbase, you simply go to the text screen and add the attribute. Most of the few other programs that have a data base capability require the user to go back and add the attribute individually to each existing item.

No one area of Drawbase is weak, although we would like to see improvement in redraw speed, especially with text. The manual is acceptable, although the tutorial is marginal. The 800 number for technical support calls is much appreciated.

We recommend buying an extra two megabytes of random-access memory and using it to run the program. Disk access is so intense that the speed of operation slows noticeably if the program runs from a conventional hard disk.

At the roundtable, Marshall Hjertstedt and James Lyman commented that Drawbase was the only program evaluated, other than Arris, that seemed of particular interest to architects. They added that the accessibility and integration of Drawbase's nongraphic data base is exemplary; however, it lacks Arris's 3D capabilities, especially in solids modeling, and its 2D capabilities did not appear better than average. Hjertstedt and Lyman, who reviewed the Arris program, concluded that Drawbase might be appropriate for architects specializing in space planning or facility management.

Voosen, reviewer of the Fastcad program, added, "Drawbase takes the bits and pieces of information that always have been lurking around CADD files and makes the data accessible to architects. But keeping track of all the miscellaneous information takes time. It's like sand poured into the works. A little is tolerable. Skok cites a 3 million-square-foot building with no two floors alike—an update of its data probably would take enough time for an architect to grow a coffee tree from scratch before making and drinking the coffee."

—Laurence E. Dieckmann, AIA, and Raymond L. Harriman

Mr. Dieckmann is a senior designer for Loebl Schlossman & Hackl, Chicago, a 110-member architecture and interior design firm. He has two years of experience with Skok's Artech CADD system on a minicomputer. Mr. Harriman is a partner in Otis Associates, a 50-member architecture firm in Northbrook, Ill. He has been working with Drawbase for a year and a half.

Fastcad

Fastcad is fun. It has the feeling and lure of a graphics game.

The fun begins with the installation, continues with the appearance of the screen, and culminates with the breakneck speed at which the program executes. In fact, the drawing power of the program is almost masked by the simplicity of its presentation.

Installation is easier—and of course faster—than for any other CADD program we've tried. With a program size of only 100 kilobytes, Fastcad could run on a laptop computer. But looks are deceiving. The program is written entirely in the lowest-level programming language, which makes it exceptionally compact and fast.

The look of the screen is even more deceiving. It is almost simplistic, like an early video game or a cheap CADD program. But behind those capital letters and funny symbols are powerful pull-down menus, graphic calls, and functions found only in serious CADD programs. Fastcad, by Evolution Computing, is priced at $2,300. Its use is not protected.

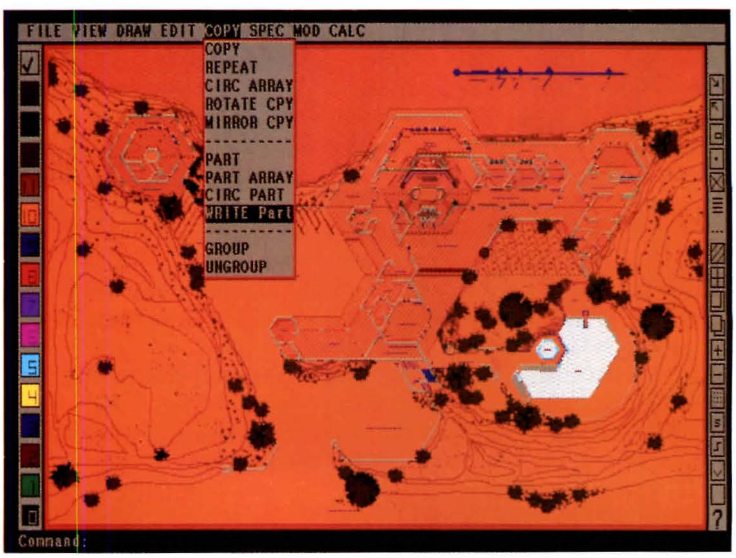
Fastcad has raw processing speed beyond any other PC-based CADD program. Redrawing the screen no longer is reason to get up for a cup of coffee. Its speed is almost the speed of thought. It's a pleasure to work with.

It's also noteworthy that the speed has been generated within the floating-point system of storing coordinate data. The vaunted speed of Cadvance is achieved by the integer method, which stores only whole numbers instead of up to 16 decimal places.

Evolution Computing also provides quick telephone support that is free although it lacks an 800 number. Users talk directly to a Fastcad developer. Comments and wish lists appear quickly in frequent updates. Staff members exude the aura of a team that is young (early Apple type) and eager to please.

Fastcad exposes itself completely to the user. No hardware or software locks are employed. Macro and script languages permit the user to alter the menus or operation of the program at will. Drawing steps can be done out of order. Colors, line styles, and even layers can be changed on the fly, while in the middle of a command.

Fastcad by Evolution Computing uses a mouse instead of a digitizer to aid "heads-up" drawing.



The manual is simple, thorough, and useful. It actually uses graphics (not common in graphics software) to demonstrate concepts. What it lacks is structure and a layout optimized for fast comprehension. The tutorial, reference, and index are composed on identical, crowded pages and bound together in a three-ring notebook. At the least, the tutorial (which is excellent) should be separated from the reference (which is heavily used).

The mouse is king at Evolution Computing. Fastcad may have the most successful implementation of the screen menu of any CADD program. A single screen with pull-down and pop-up commands contains all the information Fastcad passes to the user. Icons efficiently symbolize options that can become complex in other systems.

No user should endorse unequivocally the use of a digitizer without seeing Evolution's implementation of the mouse-and-screen alternative. The firm is committed to heads-up drawing, and it has not been done better in the IBM world. The mouse-and-screen is so good it looks as though it was written to run on a Macintosh.

Nor should anyone conclude that a dual screen is essential without seeing how Evolution can split a single screen and permit the user to draw between the views. Up to four interactive windows are supported.

Without having to keep looking from Screen One to Screen Two to Tablet Menu to Screen One ad nauseam, we find it easy to lose ourselves in the task at hand. But the task that we are evaluating for is architecture, and this is where Fastcad hits the skids.

Although Fastcad has as much raw graphics power as any CADD program, the architecture-specific routines are missing. Evolution says it intends to add 3D and a wall routine. But it resolutely denies that it ever will do windows, walls, doors, and the like. The prospect for a built-in data base is uncertain at this time.

To meet these needs, Evolution is looking to third-party vendors. Outside developers might never create as well-integrated a system of A/E applications as Evolution could create on its own. On the other hand, Apple, IBM, Autocad, and others would not be the leaders they have become without the assistance of third parties.

The prospective buyer will have to determine whether the speed of Fastcad compensates for its current lack of drawing routines. As yet, no catalog of third-party applications has been published.

Hjertstedt and Lyman considered Fastcad the quickest CADD program they'd seen, but somewhat expensive for what they see as a simple drawing program that needs third-party support to make it architectural.

Jack Cappozzo, reviewer of the Microstation program, said, "Fastcad was indeed fast but due to its philosophy of development it will not become impressive until it gets a lot of third-party support. With no symbols library, it is likely to find tough competition for sales to architects."

Harriman also agreed that Fastcad's speed and potential make it noteworthy.—John C. Voosen, AIA, and Paul J. Zinni, AIA

Mr. Voosen, who heads his own six-member architecture firm, has been working with computers since 1978. He has been a member of the AIA evaluation team since 1984. Mr. Zinni has been working with CADD for five years, mostly on mainframe computers. Both architects have offices in Chicago.

Microstation

Microstation is a personal-computer version of Intergraph Corp.'s Interactive Graphics Design System. IGDS was developed to run on VAX computers by Digital Equipment Corp. The PC version uses the same file formats and command structure that Intergraph uses. Thus, there is seamless integration of data files. Drawing files created with Microstation can be read by any other Intergraph computer, and vice versa, without a translator.

The program was developed by Bentley Systems, Lionville, Pa., and is priced at $3,000. An unlocking device is required to run the program. Late last year, Intergraph purchased 50 percent of Bentley. If an Intergraph-based client insists on transparency and a VAX computer isn't in the budget, Microstation is the only game in town.

The original market for Microstation was Intergraph users who wanted a low-cost system for viewing drawings without tying up an expensive VAX computer. It remains indispensable for that purpose. No other PC program enables a designer to guarantee a client with Intergraph trouble-free exchange of data files. A DXF file transfer routine is under development.

Today, Intergraph and Bentley are promoting Microstation as an all-purpose CADD program suitable for use by all designers, not just those with Intergraph clients. This is likely to be a more difficult sale because the basic program is neither architectural nor intuitive.

Microstation is more complicated than most CADD programs, but a routine called "environments" and a friendly keyboard input system help simplify program operation for the occasional user.

Microstation's preferred controller is a menu mounted on a digitizer with a four-button puck. The system makes limited use of screen menus but does not have pull-down menus or icons. Bentley preferred to keep the maximum amount of screen area available for graphics. The menu can be modified and macros can be written, but not as easily as with other CADD programs.

Several Intergraph peculiarities are a part of Microstation. For instance, graphic elements are read and written directly to

Intergraph's Microstation allows use of dual screens to permit up to eight views simultaneously, a plus with 3D drawing.

the disk. Thus there is no "undo" commmand. Once a change is made, the user cannot return to the condition of the file prior to the execution of the last command.

Intergraph traditionally has used two screens to display a single file, and Microstation maintains this ability. Even if only a single screen is available, the software supports a second "virtual" screen and the user can switch back and forth between the views. Each screen can be divided into four views, each independently controlled. If each screen shows adjoining halves of the drawing, the cursor will move smoothly between the screens. Elements selected are highlighted in each view, and commands may begin in one screen and terminate in the other. This makes it possible to view large drawings without getting lost. Furthermore, the ability to study several different 3D views of a building design is a significant aid in visualization.

Microstation has more graphics elements and more switches and parameters to control than most other PC-based CADD programs. Preset defaults can be used. But if the user doesn't understand the default setting, it can be difficult to track down the reason should the program behave other than as expected. This extra complexity makes the system more difficult to learn, but it also gives more power and flexibility.

The macro language used by Intergraph is supported by Microstation. Called "user commands" in Intergraph parlance, it is very powerful and more programmer-oriented than the macros in most other CADD programs. The program also supports the use of reference files, which are drawings stored on disk and brought up to compare with the current CADD file. Although the reference is visible and the user can snap to elements in it, the reference file cannot be edited. This permits an architect to overlay an engineering drawing for coordination. Also, files such as title blocks can be linked to a drawing file without consuming current file space.

On the other hand, users cannot snap to the midpoints of elements or groups of elements, nor can users snap perpendicular to them. And elements drawn on one level cannot be moved to another level.

Microstation does not support directly Intergraph's proprietary DMRS nongraphic data base, although "hooks" are provided to link Microstation files to user-supplied dBase III and other PC data base programs.

The program provides both 2D and 3D drawing power, but it is not oriented toward a specific discipline. To do architect-specific drawing tasks, Intergraph has many applications programs that use the basic IGDS drawing system. Unfortunately, few architect-specific routines have been reprogrammed for use on personal computers.

One of the outstanding features of this program is the real-time 3D mode, which generates 2D plans.

Longtime Intergraph users also have developed their own routines to do common tasks such as draw double lines for walls, insert doors, and the like. These libraries of user-specific commands are supposed to be transportable directly into Microstation, but we found that some change usually is necessary to make them work.

Microstation is a powerful graphics program, but there is little architect-specific software built into the basic program. Because it was designed for computer specialists, it could use more user-friendly controls for assisting the occasional user. Since it closely resembles the Intergraph IGDS program, plenty of application-specific software is waiting to be adapted to PC use.

Microstation does require more learning time than simpler systems, but the added capabilities—particularly the ability to handle large files and the reference file option—make it worthy of consideration by the serious CADD user.

Hjertstedt and Lyman said they would have rated Microstation higher if Intergraph appeared more interested in supporting and promoting it for architects.

Zinni concurred: "Microstation relies too heavily on third-party vendors and a link to Intergraph to be a true turnkey supplier for the A/E firm. Microstation, like Fastcad, leaves one enthusiastic about the base package but cautious about the commitment that third-party vendors will have to the specific graphics needs of an architecture firm," he said.

Dieckmann said, "I dismiss Microstation and Fastcad as not seriously architectural. They may be nice for programming freaks, but they lack utility at the base level for use in the office."—Gene L. Montgomery, AIA, and Jack Cappozzo Jr.

Ultracadd

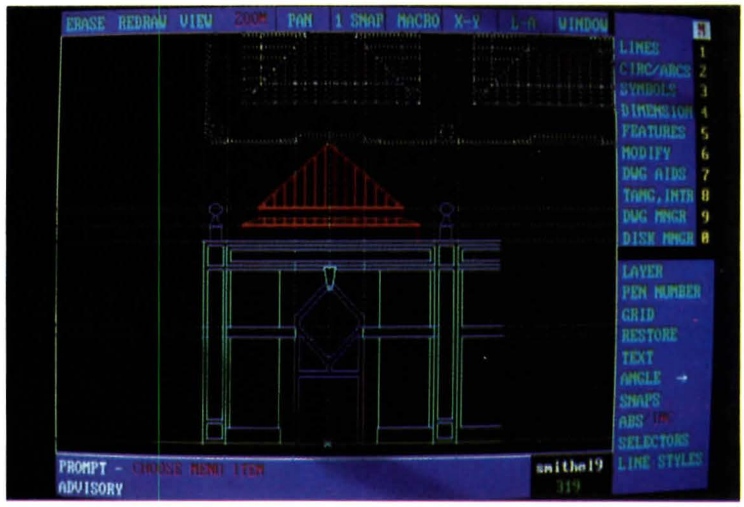
Ultracadd Plus is the newest of the programs evaluated but was among the first to integrate 2D and true 3D. It is composed of four integrated modules that can be purchased separately from Maxam Technologies. They are:

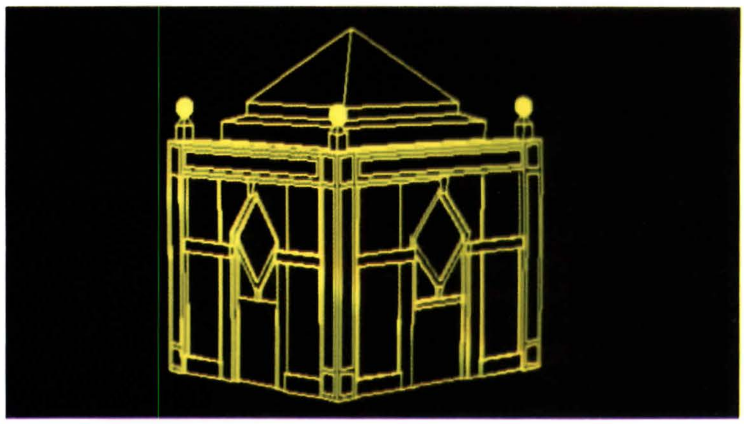
- Ultracadd 2D. Priced at $1,950, it was adapted from System 86, a generic drafting program originally written to run on a Hewlett Packard minicomputer.
- Ultracadd 3D. Also priced at $1,950, it was adapted from Design Board Professional, a purely 3D program originally written by Megacadd to run on a personal computer. It has a DXF utility that enables a 3D drawing to be exported to most 2D programs for enhancement. It also includes an internal painting and shading utility.
- Ultradesign. Priced at $2,450, it provides about 75 percent of the drafting capability of Ultracadd 2D and the full Ultracadd 3D program plus the ability to import 2D drawings through DXF. This means that it will accept an Autocad drawing for enhancement in 3D. Ultracadd 3D will not.
- Ultracadd Plus. Priced at $2,950, it combines the full capabilities of the other modules. This is the version that was evaluated.

The real promise of Ultracadd is its 2D and 3D integration, so that drawings can be sent back and forth. In the old Design Board Professional program, 3D drawing files could be exported to a 2D program but not back again. Ultracadd Plus permits architects full flexibility to draw, study, and edit without leaving the program. It is one of the first PC-based programs to offer this kind of two-way integration with a true 3D program. Arris is the only other program to demonstrate this feature, but at a higher cost.

The 2D program provides basic drafting capabilities. Although it is not specifically architectural, it can draw double lines and it has a primitive ceiling grid command. Symbols can be pur-

Mr. Cappozzo heads the architecture department at Mid-America Engineers, a 60-member Chicago firm specializing in industrial and petrochemical design. Architecture accounts for about 30 percent of the firm's revenues. The firm has been using Autocad for more than two years. Mr. Montgomery is president of Arcturus, a two-member architecture firm specializing in computer graphics in Chicago. The firm has been using an Intergraph workstation for five years.





Maxam's Ultracadd Plus uses "ghosting"—pulling up a drawing from a file and using it as a phantom image to create a new drawing.

chased at extra cost, but we did not review them. It also can produce a limited bill of materials.

As an aid in choosing a line type, eight options are displayed. To facilitate work on large drawings, the user can specify five zoom windows.

Macros in Ultracadd work like those of Point Line. A recording process remembers the sequence of keystrokes to perform a frequent function. Although this technique is easy to use, it is less powerful than a programming language such as Autolisp in Autocad.

All commands are displayed on the screen and can be selected with a mouse or digitizer. At the top of the screen is a permanent row of the "most commonly used" commands. The right side of the screen contains the main menu and all submenus. An advisory and input area appears at the bottom of the screen.

Although the main menu has a "side bar" for easy selection of submenus, it still requires going through several layers of menus to reach all the commands.

The 2D program permits walls and similar 3D shapes to be extruded from the plan view. However, you cannot create sloped roofs, and viewing is limited to outside perspectives.

Maxam has made several improvements to the Megacadd 3D program. The width of the working screen has been increased to six inches, from five inches, on a 13-inch monitor. A command line at the top of the screen resembles the 2D screen and allows the most commonly used commands to be available at all times. Hidden lines now may be removed from domes and surfaces.

When deciding how to view a model, the user now may specify the clipping planes—that is, the front and back boundaries. Another improvement is the ability to add text to the 3D drawing without having to exit the program and bring it up in 2D, as before.

The perspective construction option is excellent. The visual prompts make perspectives simple to generate. And the separate paint and show programs to display walk-arounds have not been changed.

Unfortunately, the program needs development. It still has some of the bugs that are normal in any new software. We were barely able to run the program and would be reluctant to entrust a major building to it. Technical support in solving the problems has been slow.

Attempts to run the program on three graphics display cards that supposedly are supported by the vendor were not successful. For example, when the Tecmar Graphic Master is in use, the program does not display coordinates in the dynamic rulers, and, when files are being saved, drawings are corrupted so they cannot be retrieved.

Even the IBM Enhanced Graphics Adapter was not fully supported. We could not get it to display all 16 of its colors.

Maxam does not support monochrome graphics cards because the menu system is color-coded. But although color is helpful, it is not a requirement on an affordable system.

Although the construction line feature is great—better than Point Line—the snap feature worked intermittently and was not well documented. The pan/zoom feature also is an excellent idea, but while trying to use it we caused a hardware crash.

Running the program with a Bernoulli box required a software fix, which took two weeks to deliver.

Another problem has to do with printers and plotters. If Ultracadd is configured for a printer and that printer is not attached, the program will not run. Since printers often are shared between computers, it is inconvenient to have to reconfigure the program to print data.

Manuals provided with the programs were not updated and lacked current information about the program. On the other hand, the discussion of CADD and the organization required to set up a CADD system are excellent.

Some oversights are small but inconvenient. Ultracadd lists files on drives a, b, or c. No other options are allowed. Architects with four disk drives or a RAM disk have a problem.

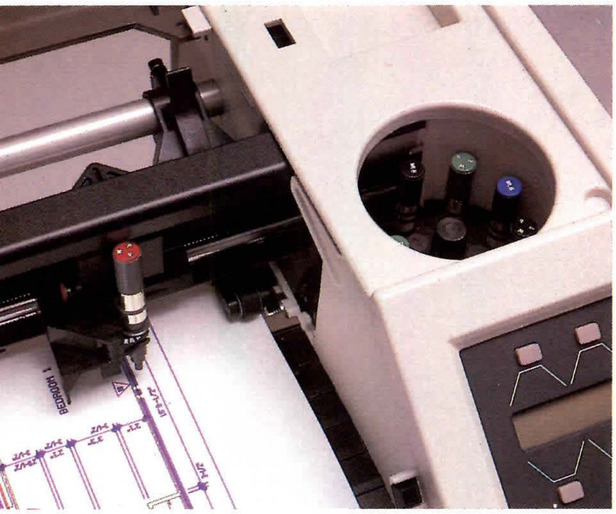
Voosen said, "I'd rank Ultracadd Plus second best because it appears to have merit as an architectural CADD program. The others tie for last because they all employ a hardware lock. It's a shame because the Arris approach to integrating an entire project promises increased productivity for architects if its speed could be improved. The next step in the evolution of intelligent CADD would be a program that can pass the NCARB exam three tries out of four."

—Kevin S. Campbell, AIA, and David J. Engelke, AIA

Mr. Campbell is a vice president of Wendell Campbell Associates, a 23-member architecture firm in Chicago. Mr. Engelke is a vice president of Potter Lawson & Pawlowsky, a 35-member architecture firm in Madison, Wis. He has been a member of the AIA evaluation team since 1984.

Introducing Exactly What You Had In Mind

The New CalComp Artisan™ Pen Plotter Model 1023.
Typical CalComp Quality And Performance At An Unusually Low Price.



ight-pen
urret can
ccommodate
allpoint,
ber or plastic
p pens,
efillable or
isposable,
ith automatic
lentification
nd recapping.

Artisan is a new easy-to-use, full-featured, high performance pen plotter that draws a full range of plots from A to D size, on cut-sheet paper and film. All with the speed, accuracy, reliability and quality output you'd expect from plotters costing twice as much.

But with none of the trade-offs you'll find in many other low-cost pen plotters.

The Artisan is fully compatible with the DEC MicroVAX II, Apple Macintosh, IBM PC and PS/2 families, as well as over 100 of the most popular CADD software packages. Even better, it offers what plotter users worldwide told us they wanted most: higher performance to meet the new sophistication and power of today's microcomputers, workstations and CADD software.

In other words, the Artisan delivers exactly what you had in mind. And more.

Artisan turns your ideas and designs into plots at speeds up to 30 inches-per-second. Its new "look ahead" feature keeps the pen moving at high speed around corners, curves and circles. Lines are sharp and true at any angle.

With resolution of .0005 inch, acceleration at 2g, capability for eight pens in any combination of ink color and pen type, and a list price of $4895, isn't the Artisan exactly what you had in mind?

We think so. We think the CalComp Artisan sets a new standard in plotting. And brings new value to plotter pricing.

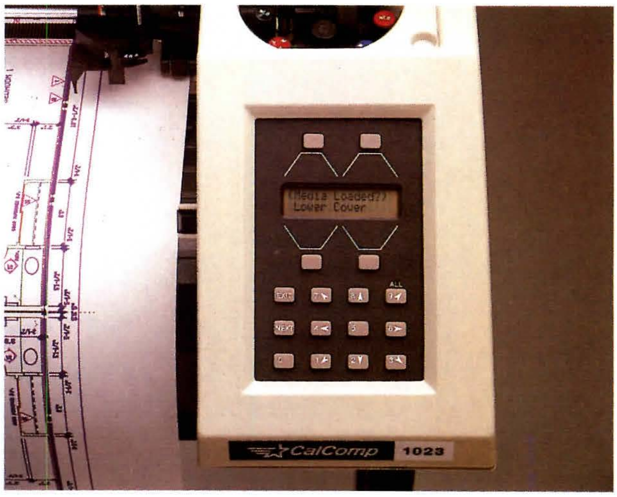
Ease your mind about dependability.

The Artisan is from CalComp, long the world leader in pen plotters. (We invented them in 1959). That gives us almost three decades of successful experience designing, developing and supporting CalComp plotters all over the world.

Now this know-how has produced a fast, accurate, dependable pen plotter for under $4900—for whatever your application.

The new CalComp Artisan. It will outperform and outlast anything you may have had in mind.

32-character liquid crystal display keypad and intelligent control panel make the Artisan easy to learn, easy to use.



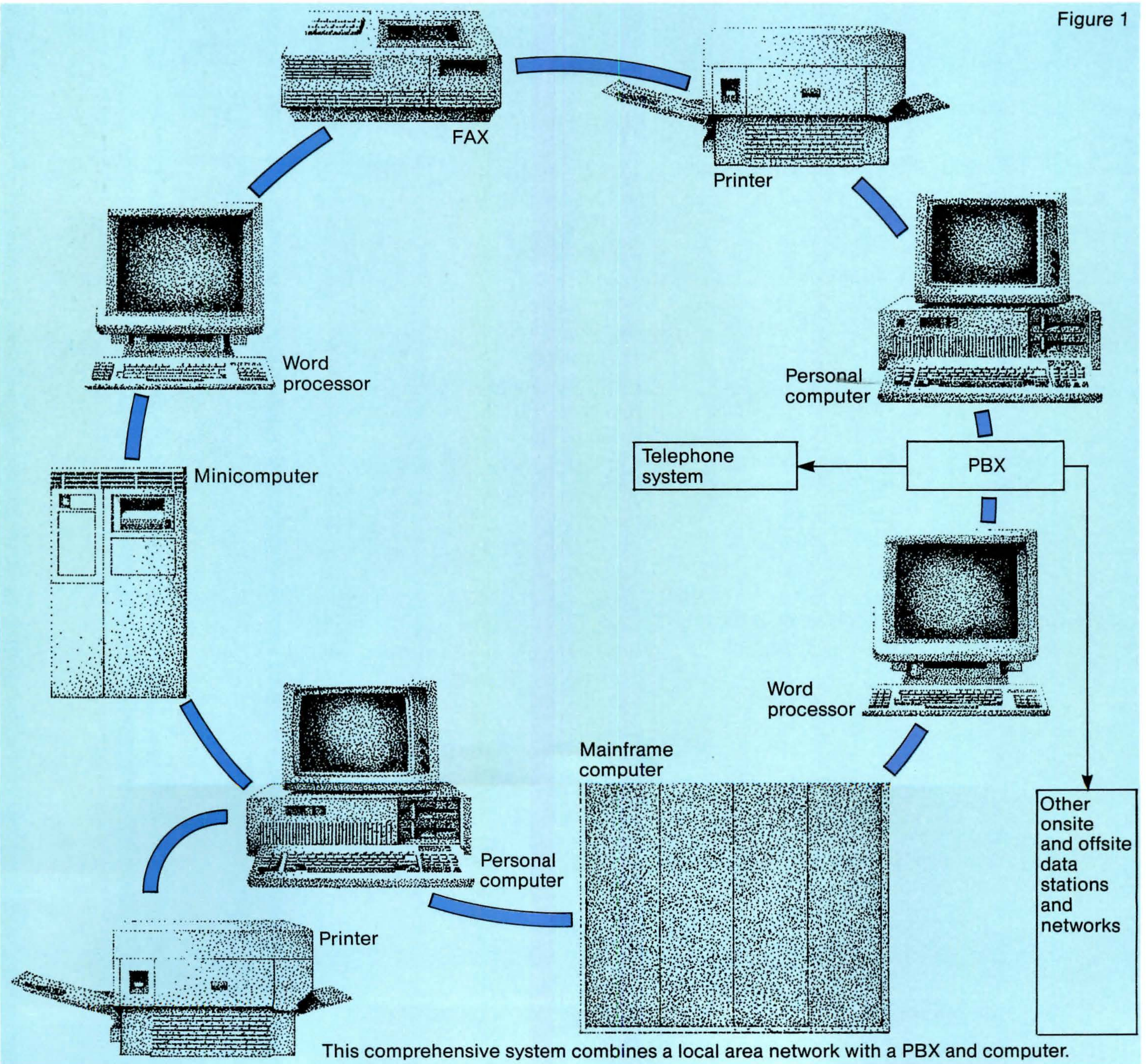
We draw on your imagination.™

CalComp
A Lockheed Company

Circle 90 on information card

The Radical Impact Of Telecommunications

As an emerging agent of design change.
By William W. Aird



This comprehensive system combines a local area network with a PBX and computer.

In the continuum of commercial building developments, some design changes have been evolutionary and gradual, while others have been radical and revolutionary. The latter are changes that have been caused by events or new developments in materials, notwithstanding changes implemented by innovative architects like Wright, Kahn, and Sullivan. One far-reaching development that immediately comes to mind is the introduction of motorized transports for people and equipment, such as elevators for office towers, escalators, and continuous moving belts. Another pair of events profoundly influencing America's architecture is Henry Ford's introduction of mass production to the automotive industry and the subsequent assembly-line organization of work. Building designers responded to these happenings by modifying their ensuing building layouts and designs to accommodate and fulfill the owners' or users' requirements.

Today, it appears that building telecommunications media and systems will be the next discipline to cause radical changes in the manner in which architects approach building design. It is difficult to pick up a technical or trade magazine without encountering the term "intelligent" or "smart" buildings or reference to their associated intelligent systems. Whereas at the end of World War II mechanical and electrical costs were less than 30 percent of a building's cost, today they are greater than 50 percent and the ratio is rising as new systems are introduced. However, the term "intelligent building" is a nebulous one. It is a business definition that is used by some to describe those buildings that include, or are designed to accommodate, extensive building electronic systems. The basic concept behind building intelligence is that a network of sensors gathers data pertaining to the building's environment, and a network of computers and microprocessors uses the information to adjust building controls to meet ever-changing conditions.

Building owners, architects, engineers, and building tenants realize that coordinating independent systems has numerous advantages: it saves money and time and can create new sources of revenue. With the breakup of AT&T, an opportunity was created to stimulate competition and increase the number of services and new technologies available to building designers. Because a typical office building's telecommunications may be relocated and retrofitted up to 30 percent annually, owners and specifiers increasingly will be concerned with where and how the communications power conductors are distributed to workstations—above hung ceilings, under floor surfaces, or through floor slabs—to minimize the building life-cycle costs.

The term "building telecommunications" normally encompasses the following information transport systems: data, telephone (voice), facilities/building automation, security, closed-circuit television (CCTV), paging, fire alarm, computer-aided design and manufacturing, and miscellaneous low-voltage information transport systems.

To be effective, telecommunications transport system design concepts must be developed during the preliminary design phases of a project. Workstation equipment and associated wiring that are affected are power distribution, airconditioning ductwork and chiller sizing, nonproductive space allocations, floor-to-floor heights, room sizes, open landscape configurations, acoustics, construction scheduling, and capital investment.

Some key issues that must be addressed during the design phase of a building include program changes, scheduling pressures, contract documentation, budget restrictions that limit design options, reliance on convention and prevailing design and construction standards, and equipment maintenance and service costs. Information about the nature of work to be done in each space is not available during the concept phase of design, but two elements that also are key to telecommunications system design are building efficiency and worker productivity.

A good idea, for the sake of convenience, is to separate telecommunications design drawings from the traditional light and power drawings. Separation is necessary to reduce the number of wires on the drawing, and it is wise because codes and standards treat telecommunications differently from light and power. It's also possible that installation will be executed under two different contracts.

Statements on design drawings that have been common in the past—for example, "install as required," "contractors to route raceways as required," or "contractors shall provide the necessary record drawings to facilitate future system maintenance"—are best avoided because they delegate too many important design decisions. The intent is that the architect/engineer or telecommunications consultant provides the required drawings so that systems can be estimated, installed, tested, and maintained without relying on a set of contractor's record drawings, which could be incomplete and usually are not available at the time of occupancy.

Common building telecommunications drawing symbols and descriptive terms must be used for all projects. But since many agencies have their own standard symbology, confusion is best avoided with a drawing legend that clearly identifies the system components, wire or other medium, and interconnections between system components. A common labeling methodology must be

Mr. Aird, president of Aird Telcom Associates, Alexandria, Va., is associate director of standards and practices with the Instrument Society of America telecom division. He was formerly chief engineer with AIA's professional systems division.

used for all projects. Design documents must include numbering and labeling that allow a user to prepare the data base *cable tracking* system prior to initial occupancy.

Figure 2 is a typical intelligent building project showing user services and telecommunications transport systems. One frequently specified transport system is a Local Area Network (LAN), for which a media diagram is depicted in Figure 1.

Control/signal transmission media

Today, data is sent over many different types of cable, such as twisted-pair, coaxial, fiber, and twinaxial. These different cable types exist because each is best in its own particular network environment. Transmission lines play an important role in most phases of control/signal work. Types of transmission lines include simple two-conductor configurations such as the familiar coaxial cable and TV parallel-wire line. Those types of lines can be used from the power region of the frequency spectrum well into the microwave region.

Coaxial cable. Coaxial cable is normally used in industrial environments to transmit video signals to remote monitors and CRT terminals. Both coaxial and twinaxial cables are common choices among control system manufacturers for various types of data/information transmissions. Twinaxial cable is two coaxial wires with a common shield and a protective cover. It offers balanced signal transmission, long cable runs, and high speed.

Coaxial cable probably is one of the best known electronic types of cabling. It consists of a single-wire conductor centered within a cylindrical outer conductor or shield. The two conductors are isolated from one another by means of various nonconductive materials. The outer conductor may consist of one or more layers of metallic braid or a rigid solid metal tube. This outer conductor usually is surrounded by a protective plastic jacket. Coaxial cable is inherently an unbalanced line. A line is known to be balanced where each conductor has the same capacitance to ground. Coaxial cable is popular because of its usefulness within a frequency bandwidth range from direct current through the radio frequencies, with relatively low cost, small size, and a variety of styles and impedances available.

The most common impedance standards for coaxial cables are 50, 75, and 93 ohms. Of those three, 75-ohm cable is the most popular for video, data transmission, and other industrial applications. Coaxial cable is supplied in sizes from microminiature to several inches in diameter, and with a variety of conductors, shields, and jackets. Coaxial cable also is used successfully for high frequencies, digital information, and wide bandwidth applications.

There are two basic forms of coaxial cable: high-voltage and RG/U type for electronic signals. High-voltage coaxial cable is designed primarily for laboratories and pulse discharge systems. It is not normally used for signal transmission because the semiconducting sheath used to reduce corona levels and to lower voltage stresses on insulation affects the cable's capacitance and signal transfer characteristics. Conversely, RG/U signal cables should not be used at excessively high voltages because no semiconducting sheath is present. RG/U type signal-carrying coaxial cables are insulated with solid, foamed, or semisolid polyethylene; solid or foamed polypropylene; or polytetrafluoroethylene (TFE). RG/U cables are used primarily for low-level signals.

Coaxial cable must be handled more carefully than other types of wire and cable. Squeezing, hitting, or stepping on it can deform the cable, changing its impedance and causing degradation of carried signals. Bending coaxial cable too sharply also causes decreased performance. Coaxial cable connections require more skill and care to install than twisted-pair electrical connections.

Twisted pair. The twisted pair has been around about as long as the need for transmission of analog signals. Twisted-pair wire consists of individually insulated pairs of conductors enclosed in a common protective jacket. Each pair is twisted with varying numbers of turns to minimize crosstalk between pairs. Each individual pair is wrapped with a metallized polyester material to shield the wires. This shield is terminated with a drain wire for connecting the metallized layer to a ground location. Multiple twisted pairs often are wound into the same cable. Although cables can consist of as few as two pairs, most of the time there will be eight, 12, 24, or more pairs.

Whereas coaxial cable is used generally in multiservice applications and always in broadband networks, the twisted pair is a single-service wire and usually is used in department systems or networks that do not require video.

Plenum cable. In some cases, the National Electrical Code allows cable insulated with a material, rather than sheathed in metal conduit, to be installed in ducts or plenums. Prior to specifying plenum-type cable, the designer should reference NEC to ensure that the design complies with NEC's most recent issue and also with, as the code books state, "the authority having jurisdiction." Usually, materials having low-flame, low-smoke characteristics are allowed to be substituted in Class 2 and 3, remote control signaling circuits, fire-protective signaling circuits, communication circuits, and coaxial cable for community antenna television systems (CATV).

The materials that first exhibited the low-flame, low-smoke characteristics necessary to pass UL-910 tests were fluoropolymers. The best known fluoropolymer is Du Pont's Teflon. The next products approved were fluorinated ethylene propylene (FEP) and TFE, which are varieties of Teflon. Although Teflon has many advantages for plenum installation, it does have disadvantages. One is its high cost. Secondly, TFE flows under mechanical stress, and it is difficult to mark and color code. TFE is limited to relatively short lengths because of the noncontinuous nature of extrusion-sintering process (the material forms a mass without melting). Furthermore, copper conductors must be silver- or nickel-plated to withstand the high sintering temperatures. FEP-insulated wire permits longer wire lengths because FEP is applied to wire on conventional extrusion equipment. Teflon-insulated cable is more expensive per foot than PVC; however, its installed cost could be much less.

Fiber optics. Fiber-optic cable has become an option during the past decade and is becoming more prevalent in its usage as building installation standards are developed and its cost continues to fall. Fiber-optic cable is an excellent choice in electromagnetic environments such as in close proximity to an arc welder or a radio transmitter. Electromagnetic fields do not disturb the flow of light through the glass conductor. However, interface equipment must be specified carefully because it can be susceptible to radiation.

Security applications are another area in which fiber-optic cable can be used. Because electrical signals are not transmitted through the cable, sensitive data cannot be tapped through electromagnetic induction. Currently, it is extremely difficult to cut into fiber and tap off information without being detected.

Fiber optics can be used in applications where electrical isolation is necessary, such as an interbuilding link. Since each of the buildings is on a different electrical current, high differences of potential can exist causing damage to the attached network devices. With optical fiber, complete immunity to damage is realized because it is not an electrical conductor. It is an excellent choice as an isolation mechanism.

Fiber-optic (FO) cable is an alternative to conventional coaxial cable, twin lead, or TV lead-in wire. The interest in FO cable results from the truly new capabilities offered to system or product designers by this technology. It is now possible to transmit analog or digital signals over many miles via optical radiation at rates equaling those of premium electronic transmission cables without problems such as electromagnetic and radio interference (EMI and RFI), lightning surges, ground looping, radiation leakage, and the task of obtaining FCC licenses. In addition, FO cables are constructed and installed similarly to coaxial cable while being lighter in weight, smaller in diameter, and capable of working over longer distances between repeaters or terminals.

A simple fiber-optic communication link consists of an optical transmitter and receiver connected by a length of optical cable. FO cable is composed of glass fibers surrounded by dielectric buffers (nonconductors of direct electric current). The fibers transmit optical instead of electrical signals. Optical signals do not require grounding connections; therefore, the transmitter and receiver are electrically isolated. Advantages include safety from sparking and shock, increased reliability due to lack of terminal-to-terminal ground potential shifts, and safe operation in hazardous or flammable environments. FO cable has been used for some time as longline telecommunications links, but now it appears that FO transmission lines are feasible, both technically and financially, as part of building services systems.

FO cable is an ideal transmission medium for audio, video, and data signals, both analog and digital. It allows more channel capacity than coaxial cable and is capable of longer cable runs between repeaters and higher bandwidths. One of the inescapable properties of coaxial cable is that, as interconnect distances increase, video systems fall victim to distributed capacitance. This results in a nonlinear attenuation curve, with higher frequencies having greater attenuation. The usual way to deal with this problem is to equalize the video signal at the source, that is, distort it to compensate for the cable's attenuation characteristics. For longer cable runs, any amplifiers or repeaters along the line must also include equalization circuitry. These equalizers must be adjusted to the length of cable involved, often a major inconvenience.

Glass optical fibers, on the other hand, have flat-ruler attenuation curves over the frequency range required for video. Thus a half-mile length of typical step-index waveguide introduces only about eight decibels of simple attenuation into the system. Digital computing, telephone, and video broadcast systems require new avenues for improved transmission, and fiber-optic systems often are more cost effective than metallic systems.

One way of classifying glass optical fibers is by their refractive index profiles and the number of modes they support. A mode is the stationary wave pattern of an individual light wave. The two main types of index profiles are step and graded. In a step-index fiber, the core has a uniform refractive index, with a distinct change, or step, between the indexes of the core and cladding. In a graded-index fiber, the core's index is not uni-

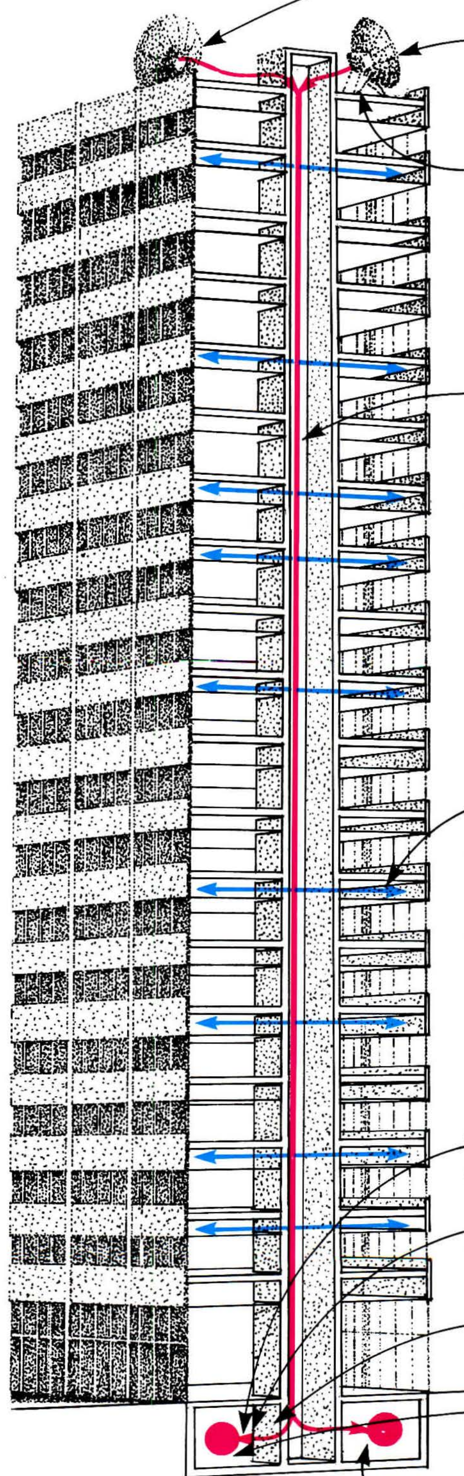


Figure 2

Controlled by the operations center, a complete horizontal and vertical system distributes information received by satellite, through cable or fiber hookups, or generated in-house.

form—it is highest at the center and decreases until it matches that of the cladding, and there is no sharp break in the refractive index continuum. There are three basic types of fiber-optic cables: multimode step-index, multimode graded-index, and single-mode (also called monomode) step-index. Currently the latter two types of cable are relatively expensive.

Multimode step-index. A multimode step-index fiber, the simplest type, has a core diameter in the range of 50 microns to more than 1,000 microns. The large core allows many modes of light propagation. Because light reflects differently for different modes, some rays follow longer paths than others. The lowest-order mode, the axial ray traveling down the center of the fiber without reflecting, arrives at the other end of the fiber first, before the higher-order modes that strike the core-to-cladding interface at close to the critical angle and therefore follow longer paths. Thus, a narrow pulse of light spreads out as it travels through the fiber. This spreading of a light pulse is called modal dispersion. Typical modal dispersion values for multimode step-index fibers are 15 to 40 nanoseconds per kilometer (ns/km).

Single-mode step index. One method of limiting modal dispersion is to use a fiber with a core diameter small enough that the fiber propagates only one mode efficiently. A single-mode fiber with a core diameter in the order of two to 10 microns is very efficient and suitable for very-high-speed, long-distance applications. Because of its small size, however, it is difficult to make fiber connections; mechanical connections must be tested thoroughly, while fusing fibers together requires a microscope. While single-mode fibers will probably find use in telecommunications and CATV, they are now used mainly in experimental and undersea trial applications.

Multimode graded-index. A graded-index fiber also limits modal dispersion. Its core is a series of concentric rings, each with a lower refractive index. Since light travels faster in a lower-index medium, light furthest from the fiber axis travels fastest. Because high-order modes have a faster average velocity than low-order modes, all modes tend to arrive at any point at nearly the same time. Modal dispersion typically is well under 10 ns/km and at times is less than one ns/km. Rays of light are not sharply reflected by the core-to-cladding interface. They are refracted successively by the differing layers of the core. The path of travel appears nearly sinusoidal. Multimode graded-index cable is the FO cable commonly used in building projects today.

Although a utility company typically brings services into a building complex, responsibility for the telecommunications equipment and selection of wiring or other media within the project belongs to the building designer. The proper selection of a telecommunications medium depends on the proposed network. For instance, if a high-speed data link is needed between buildings in a campus type environment, then fiber optics is a possible choice. Of course, the architect specifying a particular cable must be sure that the cable meets or exceeds all building and local codes. Where a cable is to be installed in an open ceiling or plenum, Teflon or other suitably coated wire probably is required. However, if the cable is to be installed in conduit, fire-protected cable is not necessary.

Cost is always a factor in any decision and usually plays a major part in the final selection. A properly specified cabling system will last for many years. Trying to cut corners in the design phase will only lead to headaches later because recabling can be very costly.

Standards and sources

Building telecommunications wiring has been around for many years to support voice communications. Voice systems, PBX and Centrex, involve centralized active equipment with individual wire runs to each station. Where these wire runs are combined into multipair cables, cost is reduced and maintenance and management simplified. Unshielded twisted-pair wire is the common medium and operates well within its performance capability.

Voice systems, with limited differences, evolved a de facto standard comprising a single medium (unshielded twisted pair), a universal connector (modular phone jack), and a star topology (a form of distributed network). Variations exist in the number of wire pairs and the connector pin assignment.

Early data systems—data PBXs—followed a similar approach. Current data systems—LANs—use a shared backbone with distributed active equipment. Their high data rates have resulted in new types of copper media and the use of optical fiber. Topologies vary according to the LAN type: bus, ring, or star.

The expansion of building wiring to include voice, video, and data, together with the proliferation of topologies, media, and connectors, confounds the user community and places restrictions on the equipment vendors. It is clear that both customers and suppliers will benefit from standards in this arena.

Until recently, very little had been accomplished in the private sector to develop building telecommunications media standards. With pressure from various user organizations, the Electronic Industries Association formed the Building Telecommunications Architecture Task Group to develop an American National Standards Institute (ANSI) standard for telecommunications building media, for instance premise wiring. Normally, mechanical/electrical trade organizations form groups and ad hoc committees comprised solely of manufacturers of equipment. But for this task group, many "user" groups and standards-making organizations also have joined, such as CSI, AIA, ISA, Washington State University, AT&T, Bell operating companies, GSA, and Northern Telecom Inc. The task group will address cable and facility architecture. Because standard development is a slow process, there is no estimated completion date for the consensus-developed standard. The approach taken by the task force is to complete its charge as soon as possible.

The days of calling Ma Bell to handle any telecommunications wiring problems are over. The architect is now responsible to the owner for the design of the premise wiring. Upon the dissolution of AT&T's consulting service, designers have turned to the Building Industry Consulting Service International (BICSI), which is a professional association serving the telecommunications and building industries. BICSI services are available from a number of sources such as BICSI members, telephone operating companies, interconnects, architects, and engineers. BICSI services encompass telephone and telegraph facilities, local area network computer facilities, and/or interior communication facilities. BICSI has published a how-to manual entitled "Telecommunications Distribution Methods Manual." BICSI's executive offices are located at the School of Extended Studies, University of South Florida, Tampa, Fla. 33620.

Assistance and service may also be obtained from IBM and AT&T, which have also developed manuals and drawings for premises wiring. And of course, in most cases, telecommunications media services involve a fee. □

Spacesaver systems are performing in thousands of distinctive structures such as The Associates Center (Chicago) and the Mutual of Omaha Plaza (Omaha).

THE ART OF ACCOMMODATING SPACE.

We share your dream of uniting form with function.

More than a decade ago, we founded a company on the universal principle that the fundamental challenge of architecture is the accommodation of space.

How to occupy it usefully.

Efficiently.

And with beauty.

With Spacesaver high-density mobile storage systems, you won't have to sacrifice your desire to create a structure that is as aesthetically pleasing as it is useful for your building's storage requirements.

No matter what type of facility you design—from libraries and law offices to hospitals and banks.

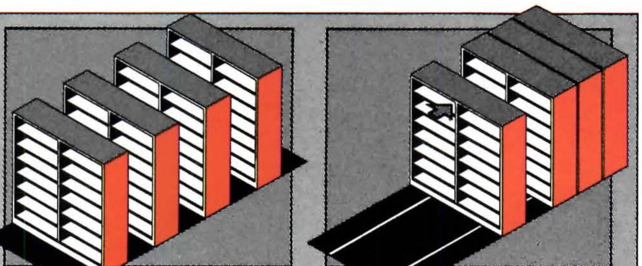
Spacesaver systems are engineered with your design goals in mind. They complement the environment you envision. They utilize available space more efficiently. They save up to half the room of stationary shelving. Or, they can double the storage capacity of the same area.

Either way, you gain the space and the freedom to design-in the architectural elements that unite form and function.

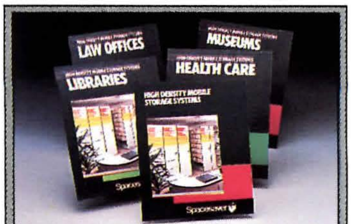
More room for atriums.

More room for terraces.

Even more room for people.



Wasted aisle space VS. productive space.
By eliminating wasteful aisles, Spacesaver systems condense storage areas freeing space for other purposes.



Contact us today to receive your free Spacesaver Design Library 1-800-492-3434.

Spacesaver®
When Performance Counts.

Spacesaver Corporation, 1450 Janesville Ave., Ft. Atkinson, WI 53538, Tel: 414-563-5546, TWX910-260-3730

Testing: Safeguard Against Failures

It is coming into wider use. By Elena Marcheso Moreno

The recent flurry of building failures has created an atmosphere of caution throughout the industry. Many designers and building owners are unwilling to take on the responsibility for rapid advances in technology alone. They want assurances that new products will perform as promised, that materials will not be subject to unexpected deterioration, and that innovative designs will account for the true actions and reactions that occur in a completed building.

Testing of components and materials is being specified at a greater rate today than ever before to provide some degree of assurance that a building will perform as it was designed. When the appropriate tests are specified, designers are less likely to be held liable for failures or problems that may arise later during construction or occupancy. Results of tests that are conducted during the design phase of a project can be used to show that an architect was acting responsibly when selecting or avoiding a certain material or assembly.

As small businesses, the majority of architects do not have the resources to perform their own tests on building materials and assemblies, which can require expensive equipment and a great deal of training. Instead, most designers turn to private testing laboratories to determine, for example, how well a wall system will perform under seismic loading or wind loading or the degree of rain penetration that can be expected. The other source of test information readily available to architects is manufacturers' voluntary testing programs.

For building assemblies, such as roofs, walls, curtain walls, and, to some extent, floors, the most relied-on test procedures tend to come from standards-setting organizations such as the American Society for Testing and Materials (ASTM), Underwriters Laboratories Inc. (UL), and Factory Mutual (FM).

The purpose of testing products and materials generally is to specify a level of performance, not to prescribe construction. Should a designer wish to try something new or to use a familiar material in a new application, specific test results and performance ratings on that product can be used to convince a building official that it will meet codes.

Meeting codes, however, is only one of the reasons for testing building assemblies. A. A. Sakhnovsky, president of Construction Research Lab in Florida, says that the business of testing building assemblies has grown rapidly over the past few years because of the number, and the publicity, of failures. Between 1983 and 1986 the test market grew by 40 percent, according to a report issued by Market Intelligence Research Co. The U.S. market accounts for 70 percent of the total, and buildings a large portion of that.

A typical wall test specimen is about 800 square feet, although some are as large as 2,000 square feet. Generally, the specimens do not meet all the requirements for all the tests, but the labs try to work with the designers to improve results.

Test results are fairly reliable, but there is no guarantee that problems won't arise because field conditions never can be duplicated exactly in the laboratory. Quality control of workmanship and installation is critical because there are always numerous opportunities for modifications at the site. In addition, specification of testing adds to project construction time. It is not uncommon for six or seven months to elapse between testing and installation of an assembly.

Sakhnovsky says that usually a manufacturer pays for these tests, which means that ultimately the cost is passed on to the building owner. Meanwhile, the manufacturer will be asked to guarantee that its product or assembly will perform as stated, and frequently as much as 10 percent of a manufacturer's payment will be retained while the assembly performance is observed in a completed building.

ASTM establishes guidelines and standards as a result of a lengthy peer review process and industry consensus. ASTM does not perform tests itself. UL and FM, on the other hand, are not consensus organizations. FM's standards writing evolved from its own underwriting guidelines and criteria for insuring buildings. The standards provided a means for the organization to establish a rating system. Buildings with materials, components, and assemblies that meet UL or FM standards are likely to be better insurance risks than those that do not. Once these internal insurance guidelines were published, they quickly were embraced by the building industry, and many of them are included in local codes.

There are a number of hazards that need to be protected against, and guidelines are provided for fire, wind, rain, and potential structural collapse, among others. FM uses several tests to measure the combustibility of and the potential flame spread from construction materials. Although these tests produce reliable results, FM is quick to point out that few tests really relate to performance under actual fire conditions. The Tunnel test is one that is frequently used (see page 123). Measurements of flame spread, fuel consumption, and smoke generated are used to calculate a product rating number on a scale where cement asbestos is zero and red oak is 100. Ratings of 25 or less indicate that the hazard from the material is relatively low. Like other testing labs, FM only provides ratings and does not judge a product's suitability.

Like tests for other properties, UL fire-resistance ratings are applied to assemblies, but individual components must meet UL criteria. This indicates that designs, not materials or products, are being rated. The influence of individual components can be significant. For example, the performance of two different ceiling systems may be similar during the test in terms of panel fallout and rooftop surface temperatures. But the temperature in the plenum of one assembly could be much higher than in the other because of thermal transmission characteristics of the ceiling material or because of different insulation. This means that steel framing members would need to be more fire resistant in the first than in the second. In this case, full-scale testing could be required to determine whether the ceiling in the example with the lower plenum temperature would perform as satisfactorily as with the higher plenum temperature. It is important to know what rating is required in a particular situation and to specify the correct materials for proper installation.

Codes often require fire-resistant roof assemblies and materials. The first edition of the Model Building Code of the National Board of Insurance Underwriters, issued in 1906, allowed only brick, slate, tin, copper, iron, and other noncombustible roofing materials. Then, in 1920, combustible roofing materials were added and the first fire tests were developed.

Roof coverings provide resistance to outside fire exposure from flying, burning embers, and flames from adjacent structures. The UL test for fire resistance of roof covering materials classifies systems based on their ability to resist fires of varying degrees of severity. When a fire occurs inside a building, it is important that the building's walls, floors, roofs, and columns do not collapse. The UL guideline involves hourly internal fire-resistance ratings of roof/ceiling assemblies and ratings for resistance and containment of fire within a building and requirements for retarding heat flow through the assembly to the exterior surface. The spread of fire on the underside of a roof deck is of concern with large expanses of open interiors. In one UL test for roof decks—UL 256—the underside flaming is not to spread beyond 10 feet during the first 10 minutes, and not beyond 14 feet for the full 30 minutes of the test.

Three fire tests are performed on most roof coverings by UL and FM: spread of flame, intermittent flame, and burning brand. For each test, a 12 mph wind blows across the test deck to simulate a likely breeze during the course of a fire. A gas flame is in continuous contact with a portion of a roof covering to test for flame spread. The flame burns for 10 minutes for Class A materials (protection against severe fire) and Class B (moderate fire protection) and 4 minutes for Class C (protection only against light exposures). To be eligible for UL or FM classification, flame spread on a system's surface must not be greater than 6 feet for Class A or 8 feet for Class B and must not extend to the top of a 13-foot deck for Class C.

The intermittent test assumes an interrupted flame, as could be the case if an adjoining building is on fire and pulsing flames are emitted from windows or other openings. The test flame is on for two minutes and off for two minutes for a specified number of cycles to determine if the covering protects a combustible roof deck from ignition. Flaming debris carried by wind is simulated by a test in which burning brands are applied to roof coverings and allowed to burn until consumed. Underside deck flaming indicates failure of the system.

FM defines a fire wall as a barrier to prevent the passage of fire from either side to the other under the most adverse conditions. Cutoff walls of lower fire resistance are incorrectly termed fire walls and cause extensive confusion among the design community about fire subdivision. Like walls, fire-resistive floors are designed to contain a fire for some period of time within the compartment where it originates and thus to inhibit its spread. Unprotected openings in walls and floors affect fire resistance, and fire-stop materials or devices are required to fill them. These through-penetrations usually contain cables, raceways, and pipes. UL has developed a specific fire testing method—UL 1479—to evaluate the performance of through-penetration fire stops. A test assembly is exposed to fire and then immediately hosed with water; all the while temperatures are being recorded. Ratings for the fire stops with through penetrations are determined by the assembly's ability to prevent passage of flame or the flaming of items on the other side and to withstand the hose stream without creating additional openings. Floors in the test assembly must support loads representative of those they would actually be carrying.

Floor coverings are governed by a critical radiant flux test that uses a radiant heat source as specified by ASTM. The test measures the distance of affected covering from a controlled source of ignition. The covering then is classified according to how much external radiation is needed for flame propagation to occur. The methenamine pill test measures the surface flame spread of carpeting that is ignited by a small source, such as a burning cigarette. An alternative test—UL 992—makes use of a test flame rather than radiant flux.

Many tests that can be performed on wall sections are more difficult to perform on roof assemblies, but that is not true of water leakage and wind uplift tests. Wind uplift is cause for a great deal of concern in roof design. A roof assembly's ability to withstand atmospheric forces is determined by wind uplift tests. UL classifies an assembly based on the performance of a 10x10-foot specimen in a test that simulates the effects of wind gusts by using oscillating external negative pressure on the top side and positive pressure on the underside of the roof assembly. UL measures wind uplift resistances as Class 15, Class 30, Class 60, or Class 90, in order of increasing resistance.

Performance of roof assemblies exposed to external forces is discussed by FM in its guideline 1-47. Wind tends to lift roof coverings through suction, internal pressure, and lifting and peeling action. According to FM, when wind strikes a wall and is deflected upward to pass over a nearly flat roof, it will reduce the pressure above the roof. Higher pressures from inside the building push air through deck and insulation joints and create a force underneath the covering that can push it off. Broken windows (damaged during a windstorm) and other openings help to increase the internal pressures, and the incoming air adds to the pressure differential caused by the suction.

Studies of snow and wind loading are more difficult to accomplish, but some labs are tackling the job. F. H. Theakson & Associates, an Ontario testing firm, conducts snow and wind simulation studies on exact models of buildings and sites and by simulating microclimates. Oak Ridge National Laboratory is currently constructing one of the first full-scale testing facilities for roofs, and it should be available for use in about one year.

Structural loading of shear-wall components is governed by a variety of standards, but ASTM E 331 governs the structural performance for windows, curtain walls, and doors under static air pressure difference. Specimens are sealed in a test chamber and air is supplied and exhausted to maintain a pressure difference. Deflections, deformations, and any failures are measured and then classified. Air leakage through windows, curtain walls, and doors is likewise classified according to ASTM specifications.

Nondestructive testing will become more prevalent as greater numbers of existing buildings are renovated. Thermography, concrete sampling, and a variety of other tests currently are being performed by testing labs. More sophisticated testing procedures are being developed by the National Bureau of Standards and are likely to be used by the building industry in the near future. One of the most promising procedures is computer enhancement of existing test methods, such as thermography, through which damage under a painted surface, for example, can be detected. With the assistance of a computer-enhanced image, the actual extent of damage can be determined. □

Prebidding, Prebuying To Cut Costs

Their promises and pitfalls. By Edwin L. Fields, AIA

For developers and architects few issues are more critical than controlling construction costs. Developers potentially can reduce construction costs by up to 15 percent of the total project budget through prebidding and prebuying components for the job.

Of course, architects and developers alike realize that one does not get something for nothing. To reap these savings, the knowledgeable developer must be willing to devote considerable up-front time to meeting and negotiating with suppliers. Prebidding and prebuying also include risks that could eliminate any potential savings if adequate precautions are not taken. Nonetheless, the advantages can outweigh the disadvantages for sophisticated developers erecting buildings costing more than $4 million.

In the traditional construction process, the developer buys a job in one of several ways. In the oldest method, the developer gives sets of architectural drawings to several contractors and accepts bids for the entire project. Each contractor in turn sends the drawings to various component suppliers or subcontractors, obtains their estimates, and plugs the best ones into the bid for the job.

A second method has the developer hiring a construction manager, who assembles the entire team of subcontractors and supervises the project through completion. Alternatively, the developer simply can contact a single contractor who provided satisfactory work on previous projects, and together they can negotiate a contract based on cost plus a fee.

However, if the developer is sophisticated and experienced enough, prebidding and prebuying may offer the best approach. In the prebid/prebuy construction process, the developer and architect decide on which significant project components can be bid before a general contractor is selected. These components are typically steel, curtain wall, elevators, mechanical equipment, and electrical systems. Although the number of components that are worthwhile to prebid is small, those components represent about 40 percent of total construction costs in a mid-rise office building.

As an example, consider the elevators. A developer (who assumes the contractor's role temporarily), accompanied by an architect, meets with the various elevator consultants and salespersons and negotiates a contract face-to-face that includes elevator features, quality, delivery, future maintenance, and price. This is a strategy for experienced developers only, because the developer knows what savings are gained only by having purchased elevators through other contractors on previous jobs.

Usually the developer and architect as a team can negotiate lower component costs because they can assure the supplier a firm sale with a long lead time. The developer has time to prepare plans that incorporate cost savings by adapting the project to the supplier's inventory or proprietary specifications, while the supplier determines the best production schedule for the dollar value.

The developer can also allow suppliers some say in the selection of equipment. For example, a developer could ask the project engineers to specify an HVAC pump with a specific rating and horsepower but allow the supplier to fulfill those specifications with whatever equipment offers the best value, subject of course to the approval of the architect and engineer. For the building facade, the architect could specify size, materials, and finish for the curtain wall but give the supplier a choice of fabrication method within limits set by the architect. Thus, under the prebidding and prebuying system the supplier is paid less money for the components but makes the same profit because the job is adjusted to the supplier's manufacturing techniques and production schedule.

Once a developer has received bids for the components, he or she can instruct prospective contractors: "Please give us a copy of your spread sheet that includes your fee and profits. We will plug in the following numbers for steel, curtain wall, and other prebid components. The contractor having the best numbers wins the job."

More often, the developer tells a contractor: "We are considering you for the job of erecting this building, and you will charge us a fee, as you do with other projects. But we are going to give you certain component prices like the steel or curtain wall, which you will plug into your bid. If you get the job, we will assign to you these component contracts we have negotiated."

The first time they use the prebidding and prebuying technique, developers often expect trouble from the contractors, but trouble doesn't materialize if the projects are substantial— usually in the $10 million to $20 million range including the contractor's fees and profits. By comparing the contractors' spread sheets, the developer can find problems, such as one trade bidding the job too high through error or too low through forgetting to include part of the work. And the contractor usually does not assume any risk in the selection of components for which the developer has already signed contracts, although the developer does assign the full responsibility of the prepurchased contract to the selected general contractor.

Aside from the benefits for developers, the prebid/prebuy process offers a considerable advantage to architects. With most developers, an architect prepares a schematic design and then waits for the developer to put the deal together before continuing with detailed design work. With prebid/prebuy, the architect becomes deeply involved in the project from the beginning, setting up budgets and making sure that the building is feasible, as well as providing the usual design services.

Prebid/prebuy also entails potential risks for the architect— specifically, liability. The architect must be certain that the devel-

Mr. Fields is a principal of Fields & Silverman Architects, a Los Angeles-based firm.

oper is knowledgeable enough to comprehend all possible risks in prepurchasing building components and setting up financial arrangements.

Moreover, the architect can mitigate liability by strictly maintaining the role of adviser to the developer during the prebid/prebuy process, without becoming a purchasing agent. In other words, the architect's service is to arrange for suppliers to provide alternative proposals from which the owner can make the final decision on each of the building components.

Architects considering a prebid/prebuy arrangement should also be aware of possible pitfalls for developers. First, a developer should never actually purchase components unless a project is definite. To guarantee the reduced prices, the developer usually has to sign a contract with the supplier. If the project does not proceed, the developer can get stuck with tons of steel or enough curtain wall for a 10-story building, unless he or she negotiates a cancellation clause, which can be costly.

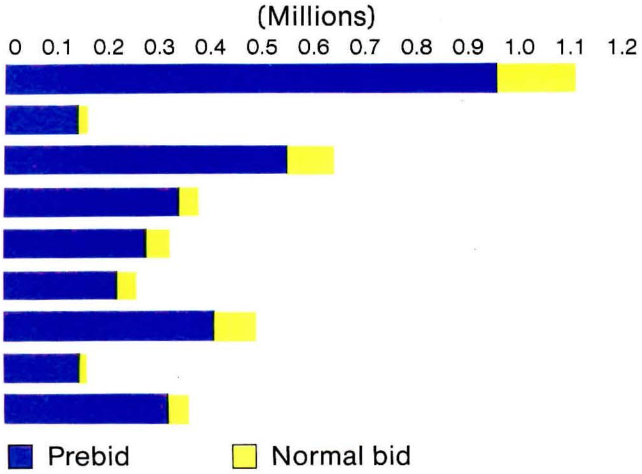
Second, developers must protect their interest in the purchase contracts for building components. For example, the earlier in the project that the developer negotiates a contract for steel, the better the price is likely to be. However, the earlier arrangements to buy steel are made, the more likely building plans are to change, requiring the steel order to be adjusted accordingly. Developers should never agree to buy 1,000 tons of steel at, say, $1,000 per ton without adding a provision that they can purchase more steel at the same price later. Otherwise, a small additional quantity of steel could cost them up to $5,000 per ton.

Third, a developer must make sure that his or her lender approves of the prebidding and prebuying for the construction job. Once the lender makes the construction loan, the lender will be committed to the developer's component contracts as well and should be prepared to release construction funds according to the provisions of those contracts.

Prebid/prebuy was successful in the construction of the Taft Entertainment Co. building, recently completed by Wolff Sesnon Buttery Development Co. in Los Angeles's North Hollywood district.

The Taft building totals 100,000 square feet of office space, with an additional 100,000 square feet for parking, located on two underground levels and on a portion of the lot. The first floor houses retail space, and the second through fifth floors are devoted to offices. The building has simple and direct facades of black and brown granite and tinted reflective glass. The lobby is clad in the same black and brown granites as the facade. Three high-speed elevators serve the parking and office floors, and a central variable-air-volume heating and airconditioning system conditions the building.

Total construction cost was $7.9 million. By using prebid/prebuy instead of the normal bidding process, the developer reduced the cost of the building's structural steel by an estimated 12 percent, from $1.1 million to $967,600. The cost of the granite cladding dropped an estimated 15 percent, from $648,000 to $551,600; and the cost of the HVAC dropped an estimated 18 percent, from $489,000 to $401,000. □



Trades concerned	Prebid	Normal bid	Savings	Savings
Structural steel	$967,601	$1,112,741	$145,140	13.04%
Metal decking	$146,000	$159,100	$13,100	8.23%
Granite cladding	$551,600	$648,130	$96,530	14.89%
Glass and glazing	$343,200	$384,160	$40,960	10.66%
Elevators	$277,000	$313,000	$36,000	11.50%
Plumbing	$223,000	$268,472	$45,472	16.94%
HVAC	$401,500	$489,000	$87,500	17.89%
Fire protection	$148,000	$165,700	$17,700	10.68%
Electrical	$314,000	$361,100	$47,100	13.04%
		Total savings (based upon trades concerned)	$529,502	13.57%
		Total scheduled value	$7,700,000	
		% Savings based upon scheduled value		6.88%

Courtesy of Fields & Silverman Architects, AIA

Heat Mirror™ takes windows out of the Dark Ages.

In days of old, controlling solar heat gain through windows meant limiting natural light as well. Today, however, there's Heat Mirror insulating glass — liberating windows and views from the gloom of dark and reflective glazings.

Compared to dark tinted or reflective glass, Heat Mirror gives you the same level of solar control, yet lets in up to four times *more* natural light. Available in any standard glass color, including clear, Heat Mirror insulating glass *is ideal* for both renovation and new construction.

Because windows (and skylights) with Heat Mirror let in more daylight, less artificial lighting is required. This means lower lighting bills and reduced air conditioning costs. And, you can often downsize HVAC equipment for significant, "up-front" cost savings.

What it all adds up to is fewer compromises. With Heat Mirror, you can maximize aesthetic opportunities without sacrificing energy efficiency.

Heat Mirror has been the state-of-the-art in insulating glass since 1981. Only Heat Mirror offers *Total Performance:* controlling summer heat gain, winter heat loss, sound transmission, ultraviolet radiation, and condensation better than any other insulating glass.

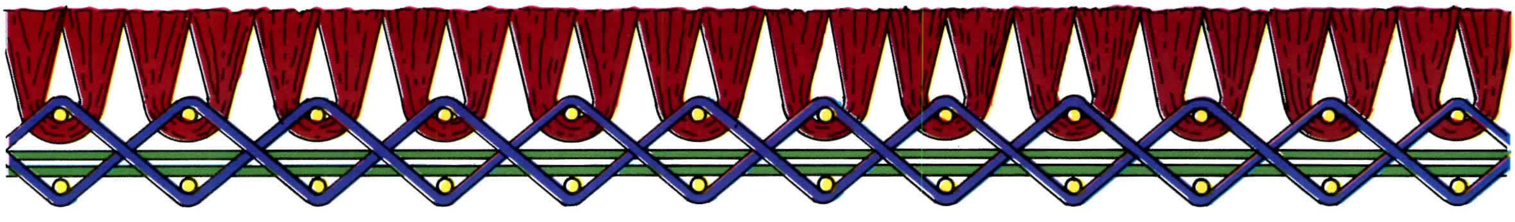
So, make the enlightened choice and join the window renaissance: specify Heat Mirror insulating glass. For details and technical information, call or write Southwall Technologies, 1029 Corporation Way, Palo Alto, CA 94303. 415-962-9111. Or see us in Sweet's: 08810/SOU.

Southwall Technologies

Heat Mirror is a trademark of Southwall Technologies

HEAT MIRROR™

For total performance windows.



Challenges of Synthetic Carpets

The ancient art of carpet weaving was historically a labor-intensive undertaking. Even with 18th-century introduction of the flying shuttle and the power loom and the 19th-century jacquard loom permitting machine weaving of intricate patterns, carpets remained expensive and limited by the size of the loom. Wider carpets, called "broadloom," became available in 1935, and the first broadloom tufted carpet appeared in 1948. Only recently have high-speed production and low-cost synthetic fibers greatly reduced the cost and increased the availability of carpet.

Until the 1950s, carpets were made solely from natural fibers, the most suitable of which is wool. Wool is flexible enough to resist crushing and bending, and it is colorfast and able to hide or repel soil. Naturally flame resistant, wool scorches at 400 degrees Fahrenheit and chars (with limited damage) at 572 degrees Fahrenheit.

Most synthetic fibers, produced from petrochemicals, are composed of permutations of three major chemicals: propane, ethane, and benzene. Propane and ethane are the two basic ingredients of acrylics. Propane, when converted to propylene and combined with ethylene, produces polypropylene (olefin) fibers. Benzene is the base ingredient of nylon, and paraxylene (a benzene-like chemical) combined with ethylene glycol is the basis of polyester.

Acrylic fibers take dyes well and are very colorfast. Acrylics' weatherability—their resistance to sunlight and moisture—make them good materials for outdoor use. Acrylics produce the least static electricity of any carpet material, and some can be compared to wool for softness, for warmth, and for having a luxurious "hand" (feel). On the minus side, the bright colors on acrylics often don't last. Though acrylic is colorfast to cleaning, as soil builds colors fade and often don't return even after cleaning. Acrylic carpets also tend to resoil quickly after cleaning. Acrylic fibers stick together when exposed to temperatures of 420 degrees Fahrenheit, and they fuse at 490 degrees Fahrenheit, leaving a permanent scar.

Olefin fibers are filaments formed from polypropylene polymers. Olefin compares favorably with nylon for abrasion resistance, durability, and strength. Unlike acrylic, polypropylene fibers resist stains, chemicals, and fading. The drawbacks of polypropylene are its lack of resiliency, poor texture retention, and its tendency to soften at relatively low temperatures (285 to 330 degrees Fahrenheit), which renders it very susceptible to scarring.

Nylon is the strongest of the synthetic fibers. It also weighs least, is longest wearing, best resists abrasion, and cleans easily. Its major drawback is that it generates more static electricity than any other carpet fiber. Nylon's nonabsorbent nature makes it resistant to some dyes, and it tends to degrade and fade gradually. Nylon melts at 414 to 480 degrees Fahrenheit and decomposes when subjected to mineral acids.

Polyester carpet fibers are usually known by their trade names, including Dacron, Fortrel, Kodel, and Vision. Polyesters are long-chained polymers of esters. Though not as durable as nylon, polyester fibers are extremely durable materials that take color well and have a luxurious "hand." Newer generations of polyester fibers show good soil resistance and also hide soil better. Unless woven with static-control yarn, polyester conducts static electricity well and will melt and fuse when subjected to heat.

To obtain optimal carpeting material, manufacturers often blend fibers. The most popular of these combinations is a 20 to 30 percent nylon and 70 to 80 percent wool blend.

Tufted carpets, first made possible by large tufting machines in the 1950s, now make up 95 percent of the U.S. carpet market. Tufting is a method of stitching a fiber yarn through a fabric backing, thus creating a loop called a tuft. The distance the yarn penetrates beyond the backing surface determines the pile height. The number of needles per inch and the spacing between them determines the carpet density. In high traffic areas, tight, dense tufting with low pile height is preferred because dense tufting increases the support of individual tufts and makes it more difficult for soil to penetrate. Dense tufting also gives the carpet greater texture retention, crush resistance, and resiliency. However, using a greater number of needles per square inch to produce a dense carpet means a greater possibility of weakening the backing fabric, and the carpet as a whole will be weaker.

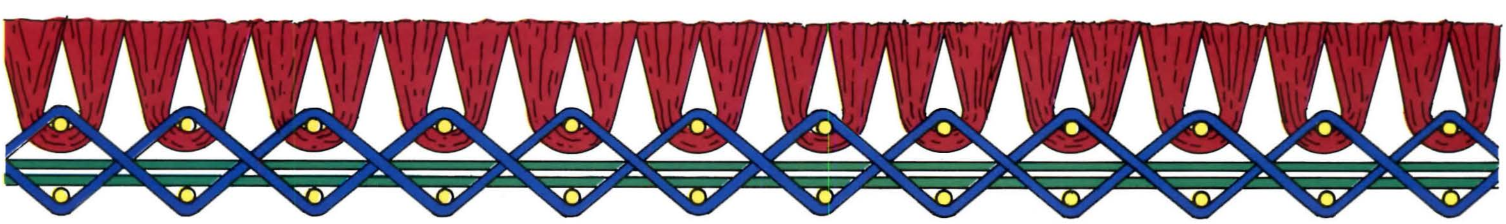
The face loops of tufted carpets can be varied in height and density to create a number of finishes—shag carpet has a high pile but is not very dense, and plush carpet has a close-cut, dense pile.

The three principal types of woven carpets—velvet, Wilton, and Axminster—no longer form a major portion of the carpet market. Because of their construction, in which the surface yarn and backing material are interlocked in the weaving process, woven carpets are very stable dimensionally and very hard wearing, especially in heavy traffic areas. Velvet is the one most widely recommended.

"Needle-bonded" and "needle-punched" both refer to a method of construction that uses barbed needles to punch and compress a web of fibers into a coherent, felt-like scrim. Although one of the oldest methods of carpet construction, it is best known today as the method with which "indoor-outdoor" carpet is made. Actually, almost 85 percent of needle-bonded carpet is used indoors where an inexpensive, slip-resistant surface is required. Needle-bonded carpet is limited to a relatively flat texture.

Carpet backing fabric, needed to give dimensional stability to the carpet, to prevent buckling, and to add wear life and physical depth, can be either a natural or synthetic material.

A carpet's primary backing, the material to which the yarn is sewn or woven,



is a component of its construction. A second backing, usually jute or polypropylene, normally is laminated to the primary backing using synthetic rubber latex. Latex may also be used on tufted carpets to secure the tufts to the primary backing. This method, called unitary backing, is most appropriate for glue-down installations.

Jute, despite inroads made by synthetic materials, remains a popular primary and secondary backing material. Jute is dimensionally stable yet able to stretch, is insensitive to heat, and also is easy to sew, making it ideal for either hot-melt taped or sewn seams. Jute makes a good secondary backing material because it absorbs adhesives, allowing them to penetrate, thereby assuring an excellent bond between the secondary backing and the substrate. However, jute may shrink or produce stains on the carpet surface when wet.

Woven or unwoven polypropylene is the most commonly used primary backing material for tufted carpets. (Needle-punched carpets employ a woven polypropylene supporting scrim.) Polypropylene backings are nonabsorbent and, when combined with synthetic fibers, produce a colorfast and weather-resistant carpet. Polypropylene, however, is too heat-sensitive for hot-melt tape applications. Dense tufting tends to weaken or distort polypropylene, and when cut or seamed it can unravel or fray.

Cushions

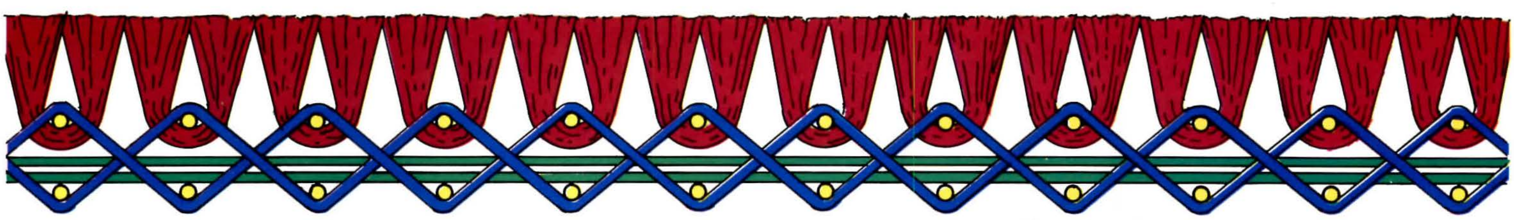
Carpet cushions can be attached to the carpet, sandwiched between the primary and the secondary backing, or can come as a separate piece. Carpets without integrated cushions are recommended where large areas of carpet are to be laid because they are able to stretch and produce a seam that won't open up. Carpets with attached cushions are usually glued down without being stretched.

Natural hair or fiber cushions, suitable for above-grade applications only, are usually mothproof, sterile, and noncombustible. They do however tend to matt down gradually and can mildew if they get wet. Sponge rubber or foam cushions may not meet flammability standards, but manufacturers say that urethane cushions are unaffected by heat or by moisture. Urethane cushions also have excellent sound insulating qualities and don't crumble, oxidize, or deteriorate with age. They are often laminated to a slip-resistant surface material to give the cushion dimensional stability and abrasion resistance.

Installation

Carpets are installed using either the glue-down method or the tackless (without glue) method. Glue-down carpet, best for heavily trafficked areas, is laid directly over the substrate. A concrete substrate always must be allowed to dry properly before the glue-down carpet is laid, and in some cases it may have to be treated with a glue-compatible sealer. Installers must allow enough time for the adhesive to develop tack and must ascertain that an adequate amount of adhesive is applied.

Tackless installations are limited to carpets with secondary fabric backings and are most often stretched over the cushion or underlayment. Proper stretching by an experienced installer and careful pad selection are the two most important aspects for a proper tackless installation.



Other considerations

Flammability. Flammability of the carpet itself is measured by FF 1-70—the "pill test"—required by the Consumer Products and Safety Commission for all carpets manufactured in or imported into the United States. The carpet manufacturer submits eight identical 9x9-inch carpet specimens, onto which methenamine tablets are dropped. The flames produced by each tablet must not spread more than three inches from the point of ignition, and, if more than one specimen of eight fails, that carpet type may not be sold in the United States.

The "tunnel test" measures flammability of a carpet that is not the source of combustion. Unlike the pill test, it is recognized by all the model building codes, the National Fire Protection Association, and the American Society for Testing and Materials. The tunnel test subjects a carpet specimen to a varied range of radiant energy (measured in watts per square centimeter) along its length. One end of the carpet is ignited, and the distance it burns is measured. Also noted is the level of radiant energy exposure at the point when the carpet self-extinguishes, called the "critical radiant flux." Critics question the ability of both the pill and tunnel tests to measure the hazards encountered in an actual fire.

Smoke. Burning carpets and cushions can generate a toxic and suffocating smoke, often more hazardous than the fire itself. But as yet there is no adequate test to measure and predict the potential hazards of a particular carpet or cushion.

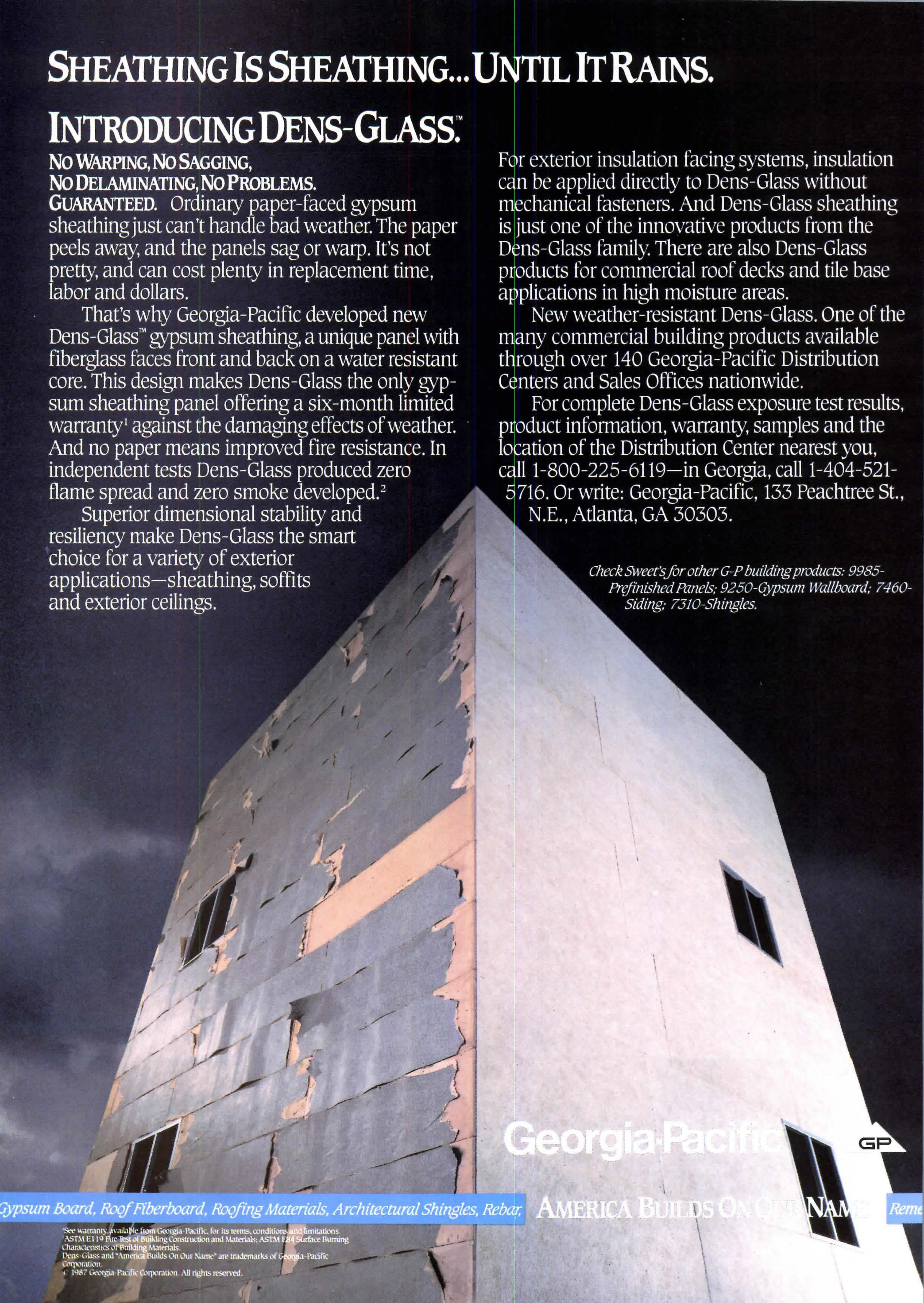
Off-gassing. Though concern for indoor air pollution caused by off-gassing of synthetic materials has grown, testing methods and standards for off-gassing of carpets are still in their infancy.

Static electricity. Static electricity from carpeting ranges from a nuisance to a danger in buildings where sensitive electronic equipment or explosive materials are housed. To control static discharges, the architect can suggest a carefully balanced and maintained HVAC system to keep the building's relative humidity level above 40 percent. Antistatic carpet sprays work, but they lose effectiveness with normal abrasion and shampooing and also tend to attract dirt. The best preventative for static electricity may be a carpet with fine metallic fibers in its pile, which permanently dissipate the electricity.

Airborne sound transmission. Carpet controls not only airborne sound transmission, but impact noise as well. The acoustic properties of practically any flooring system will be improved by the addition of a carpet and cushion (see Nov. 1987, page 107.) Within the ⅛- to ½-inch pile range, the greater the pile height, the greater the sound absorption. The type and density of both the carpet and cushion will also affect their sound absorption properties regardless of the floor or installation type.

Slip resistance. Thick carpets or carpets with cushions may be dangerous in areas where wheelchairs and carts are used. Additionally, some carpeting gets very slippery when wet, and, although mildew-resistant carpeting is now available for pool areas, an architect should check with the manufacturer about slip resistance before specifying for this type of installation in areas where the floor surface is expected to get wet.

For more information contact the Carpet and Rug Institute, P.O. Box 2048, Dalton, Ga. 30722—TIMOTHY B. MCDONALD



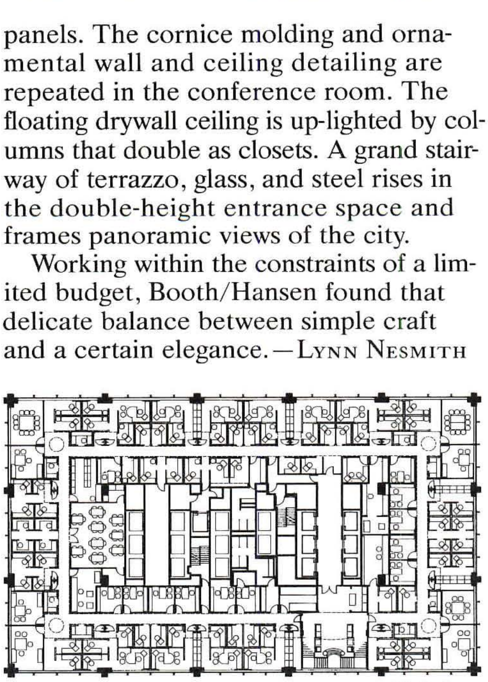
SHEATHING IS SHEATHING... UNTIL IT RAINS.
INTRODUCING DENS-GLASS.™
NO WARPING, NO SAGGING, NO DELAMINATING, NO PROBLEMS.
GUARANTEED. Ordinary paper-faced gypsum sheathing just can't handle bad weather. The paper peels away, and the panels sag or warp. It's not pretty, and can cost plenty in replacement time, labor and dollars.
That's why Georgia-Pacific developed new Dens-Glass™ gypsum sheathing, a unique panel with fiberglass faces front and back on a water resistant core. This design makes Dens-Glass the only gypsum sheathing panel offering a six-month limited warranty[1] against the damaging effects of weather. And no paper means improved fire resistance. In independent tests Dens-Glass produced zero flame spread and zero smoke developed.[2]
Superior dimensional stability and resiliency make Dens-Glass the smart choice for a variety of exterior applications—sheathing, soffits and exterior ceilings.
For exterior insulation facing systems, insulation can be applied directly to Dens-Glass without mechanical fasteners. And Dens-Glass sheathing is just one of the innovative products from the Dens-Glass family. There are also Dens-Glass products for commercial roof decks and tile base applications in high moisture areas.
New weather-resistant Dens-Glass. One of the many commercial building products available through over 140 Georgia-Pacific Distribution Centers and Sales Offices nationwide.
For complete Dens-Glass exposure test results, product information, warranty, samples and the location of the Distribution Center nearest you, call 1-800-225-6119—in Georgia, call 1-404-521-5716. Or write: Georgia-Pacific, 133 Peachtree St., N.E., Atlanta, GA 30303.
Check Sweet's for other G-P building products: 9985-Prefinished Panels; 9250-Gypsum Wallboard; 7460-Siding; 7310-Shingles.
Georgia-Pacific
GP
Gypsum Board, Roof Fiberboard, Roofing Materials, Architectural Shingles, Rebar,
AMERICA BUILDS
[1]See warranty, available from Georgia-Pacific, for its terms, conditions and limitations.
[2]ASTM E119 Fire Test of Building Construction and Materials; ASTM E84 Surface Burning Characteristics of Building Materials.
Dens-Glass and "America Builds On Our Name" are trademarks of Georgia-Pacific Corporation.
© 1987 Georgia-Pacific Corporation. All rights reserved.

Interiors

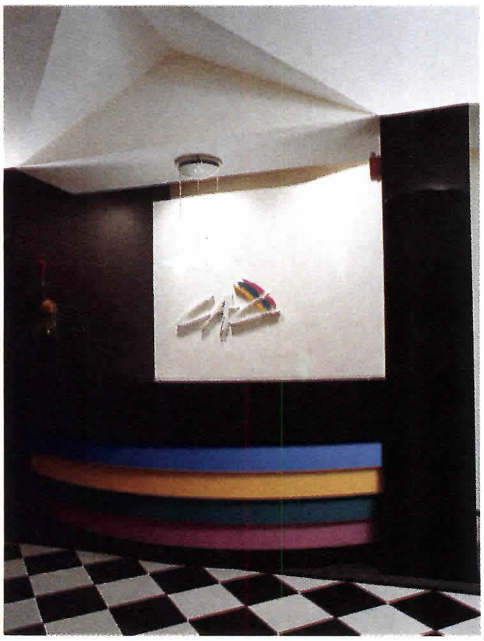
Booth/Hansen & Associates used simple forms and a warm palette to create a pleasant work place for the Chicago branch of the Illinois Housing and Development Authority. To avoid the bland environment that has come to symbolize bureaucratic offices, the architect created a silk-screen stencil pattern to highlight and unify the 40,000-square-foot space and incorporated HID lighting and natural light with standard fluorescent systems. The abstracted Prairie flower design, which Laurence Booth, FAIA, calls "an homage to the Midwest," is used floor-to-ceiling in some offices, as banding along the upper walls, and in the backlighted circular domes set in each of the four corners.

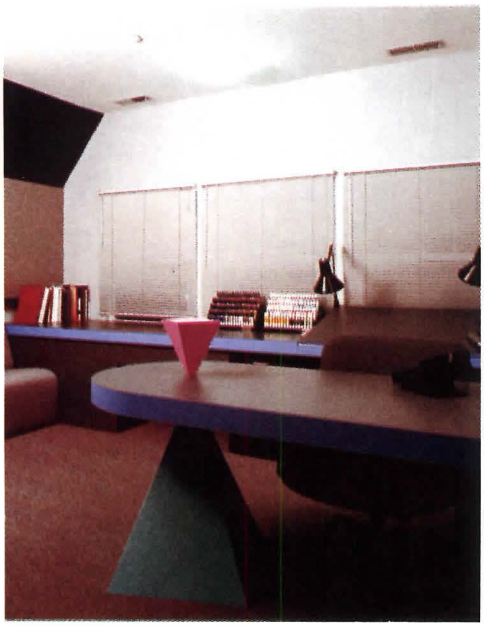
To maintain windows for staff work areas, some private offices are located away from the perimeter. As a trade-off for no windows, these offices have vaulted ceilings with up-lighting and detailed glass wall panels. The cornice molding and ornamental wall and ceiling detailing are repeated in the conference room. The floating drywall ceiling is up-lighted by columns that double as closets. A grand stairway of terrazzo, glass, and steel rises in the double-height entrance space and frames panoramic views of the city.

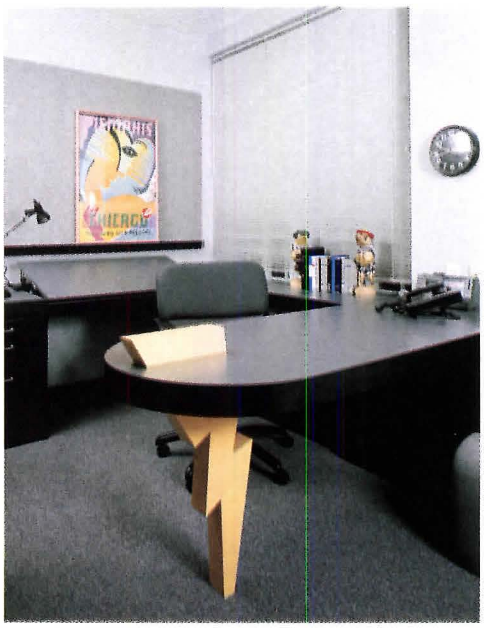
Working within the constraints of a limited budget, Booth/Hansen found that delicate balance between simple craft and a certain elegance.—Lynn Nesmith



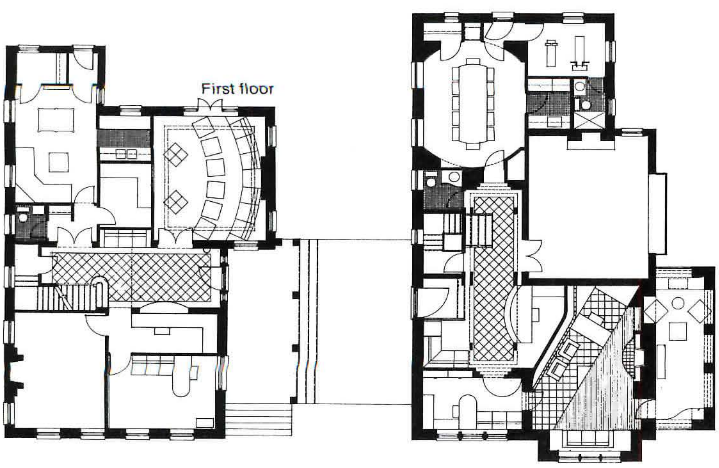
Ninth floor

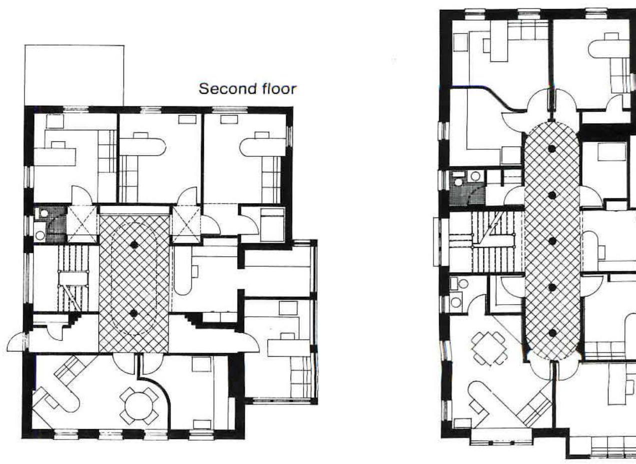


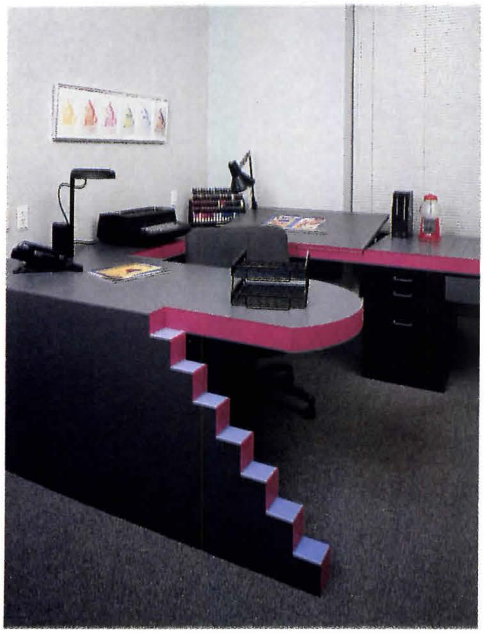




Photographs by Douglas Abel







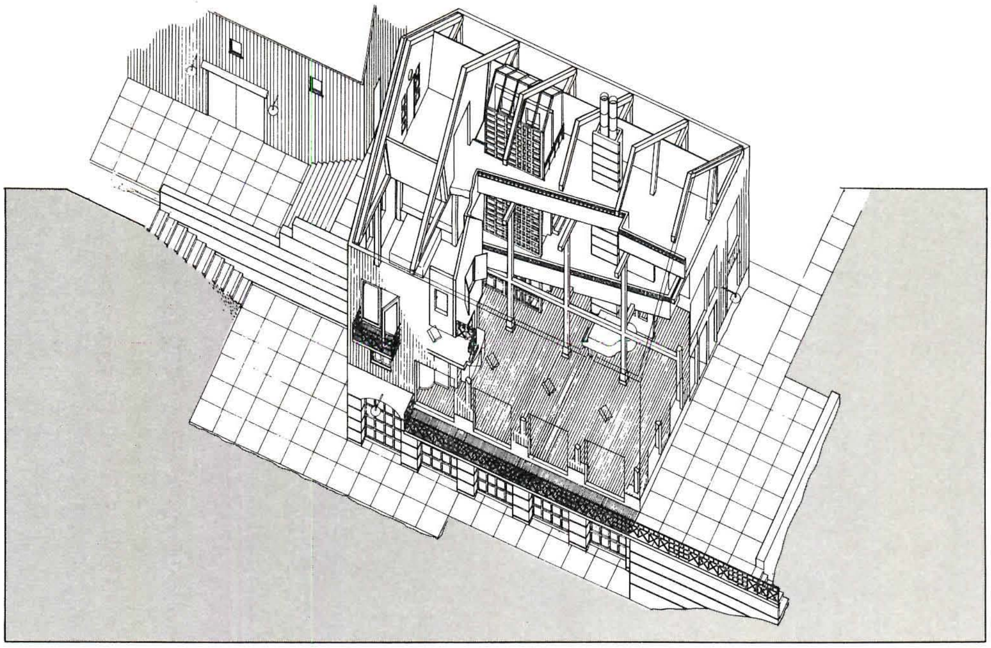
The Lawrence Group of St. Louis created a bold but neutral backdrop for the Centra Advertising Co. in two adjacent turn-of-the-century houses in the city's historic Central West End.

Each of the 6,000-square-foot buildings was gutted and reorganized around a central gallery space accented with a row of columns. On the ground floor of both buildings, the oblong gallery is surrounded by the conference and presentation rooms, the reception area, and the executive director's office (opposite page, top right). Private offices for the creative staff ring this central space on the upper floors.

Design principal Stephen A. Smith says, "We wanted three things to stand out—the employees, the advertising they produce, and the workplace or more specifically the desks." And the desks are what make this project so special. While the overall color scheme is black and white and gray, the desks in muted primary colors provide bold accents throughout.

The architect created 45 different designs for the workstations and then allowed the employees to pick their own designs and colors. Tops and drawer bases were interchangeable; the element holding up the desk was the variable. In addition, optional components meet the different needs of writers, artists, and others. The five shown above illustrate the diversity of the finished products; however, Smith admits that one of the most outlandish designs, a tongue extended from a pair of bright red lips, was not selected. The budget was moderate and the custom desks were built by a local firm for about the same cost as comparable off-the-shelf furniture.

A wide array of lighting was used throughout—fluorescent, incandescent, and colorful pendant fixtures in the managers' offices. The architect was also involved in the selection of office equipment and accessories.—Lynn Nesmith



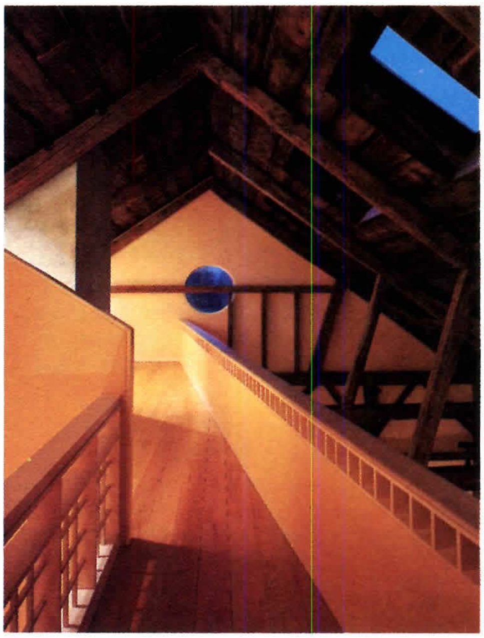
Jeffrey and Karen Weinsten's residence near North Salem, Westchester County, N.Y., blends old with new in an unusual way. Set on a bucolic 50-acre site, two buildings—one the house and the other a garage/studio and guest apartment—are built on 19th-century barn frames the clients purchased in Maine, intending to use them for a residence. They then numbered, disassembled, and shipped the frames to the upstate New York site.

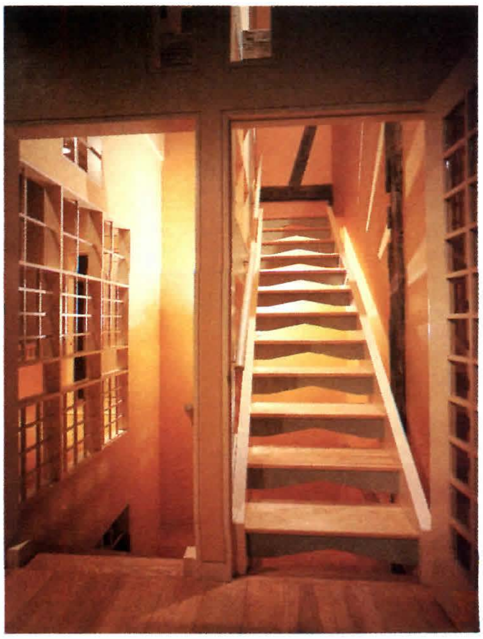
Errol Barron, AIA, of the New Orleans firm Errol Barron/Michael Toups Architects says he kept the geometry of the barn frames intact as much as possible while exposing the barns' framing in the interior of the house. Wood from a third barn sheathes both structures. The frames were re-erected over concrete foundations and, in the case of the residence, over a large basement floor that cuts into the sloping hillside. Although the two buildings are apparently separate, they connect below grade.

Barron positioned interior walls so as to contrast with and set off the geometry and character of the barn frames, resulting in an open volume that retains and celebrates the precise and logical quality of the original structures. Bedrooms, library, and study—collectively arranged in an L shape—overlook a three-story living room. Barron custom-designed the woodwork, which was crafted by a local cabinetmaker. The wood detail and cabinets are poplar; the hardwood flooring is six-inch-wide boards of ash.

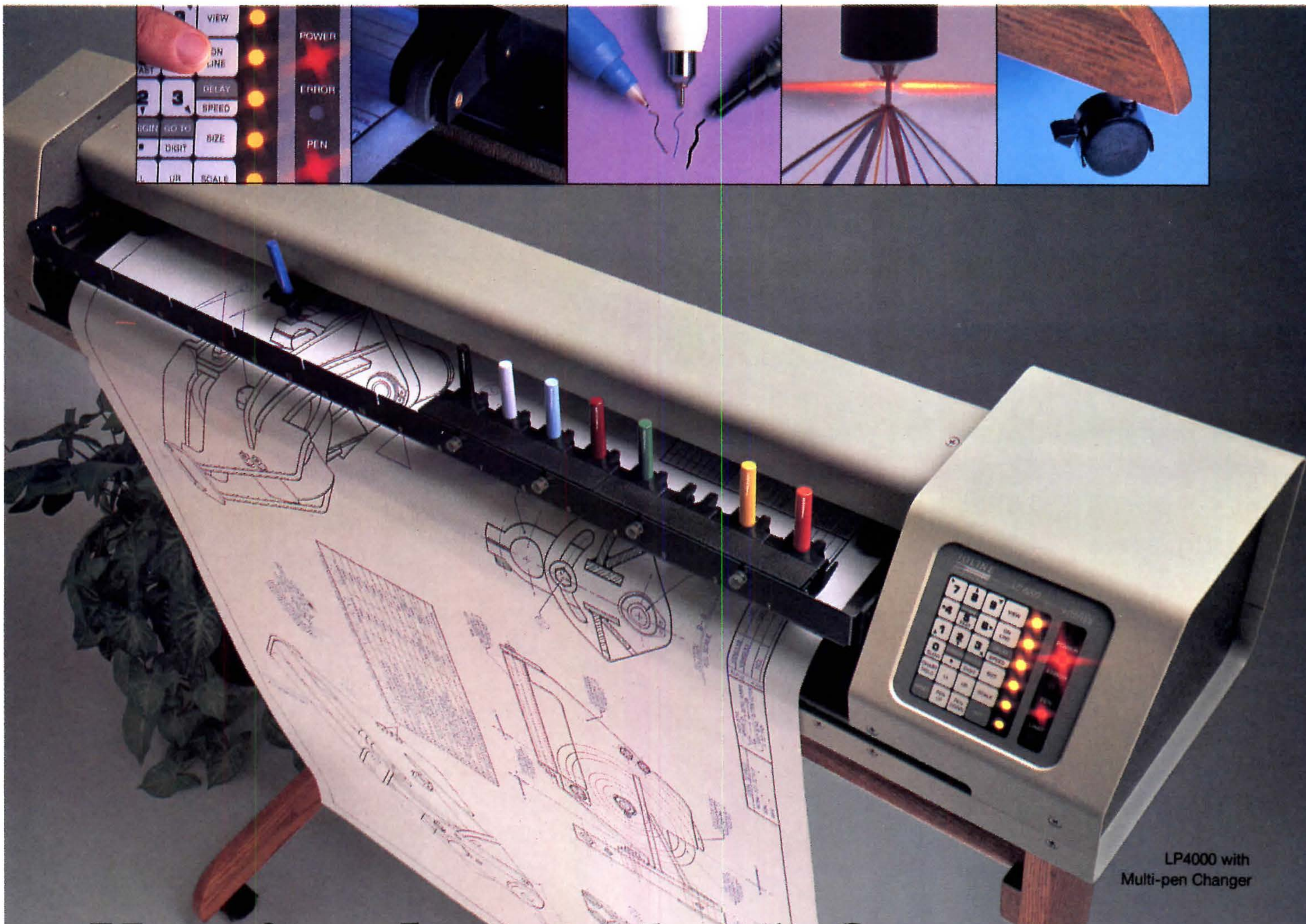
French doors and terraces overlook a stream, the sets of glass doors and windows resulting in a light, airy view of the countryside from the back of the house. The window placement on the opposite (entry) side was carefully studied so that this side retains a barnlike character as one approaches from the road. It has an austere appearance and conveys an impression of two very old and isolated buildings left from another time.

—Amy Gray Light





Photographs © Alan Karchmer



LP4000 with Multi-pen Changer

Here's what to look for when you want great value

IOLINE plotters are designed to give you more flexibility and features for less cost than any other machine of their kind.

For example, our plotters draw not only on A through E sizes of media, but also plot on hundreds of in-between sizes from 1.5″×1.5″ up to 37″ wide roll stock. This saves you time and money by allowing you to make "check plots" on small, low-cost paper before committing to full-size media for final work.

It's easy also to set paper size, pen speed, micro-calibration, plot rotation—everything exactly as you want—by just tapping a few keys on the plotter's intelligent keypad. Plus, up to 3 sets of personalized defaults can be saved in its non-volatile memory.

They're fast, too. Our high-performance LP4000™ draws at speeds selectable up to 20 inches per second (ips) axially with .001″ resolution. For less demanding applications, our economical LP3700™ plots up to 10 ips axially with .0025″ resolution.

Another feature is compatibility. IOLINE plotters emulate both HP-GL and DM/PL plotter languages so they work with a host of software like AutoCAD, VersaCAD, and CADKEY, to name a few.

Furthermore, our Multi-pen Changer™ option holds up to 20 pens and, with our hyperBUFFER™ option, you can dramatically increase plotting throughput with intelligent vector sorting and compression buffering of up to 1MB of plot data.

Now here's the clincher: Our top-gun LP4000 costs just $5,495* less options. And there are other models priced even lower!

Why wait? Call us now at **1-206-775-7861.** Or, circle our reader service number and we'll gladly send you our brochure.

Remember, getting your money's worth—that's what IOLINE plotters are all about.

IOLINE™

LARGE-FORMAT PEN PLOTTERS

Furnishings

Furniture Based on National Monuments
Washington, D.C.-based designer Karen C. Burchette draws inspiration for her line of home and office furniture from her interpretations of Washington's national monuments. Examples of the limited edition work (shown at right) include chairs based on the Lincoln and Jefferson memorials, the Washington Monument, the Capitol, the Hirshhorn Museum, and the Taft Memorial Bell Tower, among others. Pieces can be customized to meet individual specifications.
Country Garden Ltd.
Circle 243 on information card

'Neon' Chair
Kinetics' Neon chair, shown above, designed by Paolo Favaretto with Giancarlo Bisaglia, features a cantilevered frame and a back and "floating" seat of molded structural urethane. The frame comes in 24 colors plus chrome; the back and seat are finished in kintone (a trademarked company name for a special kind of laminate) or black.
Kinetics
Circle 242 on information card

Products *is written by Amy Gray Light.*

Contemporary Wood Designs
Wood furniture designer Carl Gromoll "endeavors to incorporate the characters of wood into products people can use regularly and that offer sustained esthetic pleasure," he says. Gromoll's High Rocker, 40x30x42 inches, and Rocking Foot Stool, 12x18x18 inches, shown above, are made of Finnish birch plywood that has been stack-laminated, carved, and hand-rubbed. The Black coffee table, 17x42x42 inches, is fabricated the same way as the rocker and stool. The table is dyed black, clear-coated with polyurethane, and bolted together.
Carl Gromoll Wood Works Designs
Circle 241 on information card

Wood, from Floors To Ceiling Systems

Wood Flooring
Trus Joist Corp.'s Silent Floor residential joists feature lightweight structural I-configured wood joists with Micro-Lam lumber flanges and plywood webs. Used for both floor and roof joists, they reputedly eliminate floor squeaks, as they are designed not to shrink, warp, or twist before or after installation. The joists are available in lengths up to 60 feet with knockout holes 1½ inches in diameter every 12 inches.

PermaGrain Products Inc. offers hardwood flooring samples with tiles, technical data, maintenance information, and specifications, available for the company's Pennwood line, which comes in oak, ash, walnut, maple, and cherry. Available in a stained, wax, or urethane finish, and in parquet and one-directional patterns, Pennwood comes in 12-inch tongue-and-groove tiles. The wood tile may be installed through dry-back, foam-back, or self-stick applications. Also available is Tupelo Wood Plank, an acrylic-impregnated wood flooring designed to remain stain and soil resistant. Tupelo is manufactured in 2¾x48x9⁹⁄₁₆-inch planks, and features a five-ply lamination, eased edge, and tongue-and-groove installation.

Kentucky Wood Floors Custom Classics, Plank, and Parquet hardwood floors are available prefinished or unfinished, with
continued on page 136

Products *from page 135*
custom borders available. A brochure details the entire line and gives installation, finishing, and maintenance recommendations. The manufacturer's newly introduced Burl Walnut custom flooring is ¾x18x18 inches and is composed of a 12x12-inch Burl Walnut wood center. It is also available in 10x10-inch modules. All floors are designed to glue directly to any smooth, level, dry, and sound substrate.

Hartco Pattern-Plus custom wood flooring from Tibbals Flooring Co. features prefinished hardwood floorings that can be installed in a variety of designs. Units are engineered in modular dimensions—one width of 4½ inches and in four lengths of 9, 18, 27, and 36 inches. A catalog and samples are available. Two white wood floorings from Tibbals are prefinished with polyurethane for easy maintenance and come with a line of job-specific floor care products including a white paste wax and white wood touch-up kit. Hartco Winter White parquet is 100 percent Appalachian oak, engineered in 12x12-inch units made of four 6x6-inch squares. Each unit has tapered tongues and grooves. Hartco Aspen White Pattern-Plus comes in four modular-sized units, each in a 4½-inch width and in 9-, 18-, 27-, and 36-inch lengths.

Chickasaw Custom Oak Strip from Memphis Hardwood Flooring Co. is available prefinished at the factory in natural, antique, or amber colors, or unfinished but presanded for on-site finishing with stain and seal or a finish coating. Prefinished styles are sanded, sealed, and waxed, and the unfinished version is presanded at the factory, requiring only a final, light sanding at the job site before finish application. The red and white oak boards are 2¼ inches wide and ¾ inches thick, with side and end matches. Side edges are beveled 3/32 inch before sanding. The boards are installed by nailing over wood subfloors, screeds, plywood-on-slab, or old wood floors. The oak strip is packaged in eight-foot nested cartons, 18 square feet per carton.

Trus Joist Corporation
Circle 246 on information card
PermaGrain Products Inc.
Circle 247 on information card
Kentucky Wood Floors
Circle 248 on information card
Tibbals Flooring Company
Circle 249 and 250 on information card
Memphis Hardwood Flooring Company
Circle 251 on information card

Floor Underlayments

The American Plywood Association issues two pamphlets on the sources and applications of plywood underlayment for use beneath thin resilient floor coverings. The APA plywood grades recommended for this have smooth sanded surfaces and a special inner ply construction to help resist dents and punctures from concentrated loads. "APA Data File: Preparation of Plywood Underlayment for Thin Resilient (Non-textile) Flooring," Form L335, contains application recommendations, including grade selection, panel preparation, spacing, and nailing. A companion brochure, "APA Source List: Plywood Underlayment for Use Under Resilient Finish Flooring," Form L330, lists two dozen APA member manufacturers producing one or more of the recommended underlayment grades. Available panel thicknesses are also listed by manufacturer, and typical APA plywood underlayment trademark facsimiles are contained in both brochures.

Piran Poly Sealer from the Randustrial Corp. is a one-coat polyurethane floor sealer designed to protect wood and concrete floors from dirt and grime and to guard against oil, grease, and chemical spillages. Drying to a gloss in two hours, one gallon reputedly covers approximately 300 square feet of flooring.

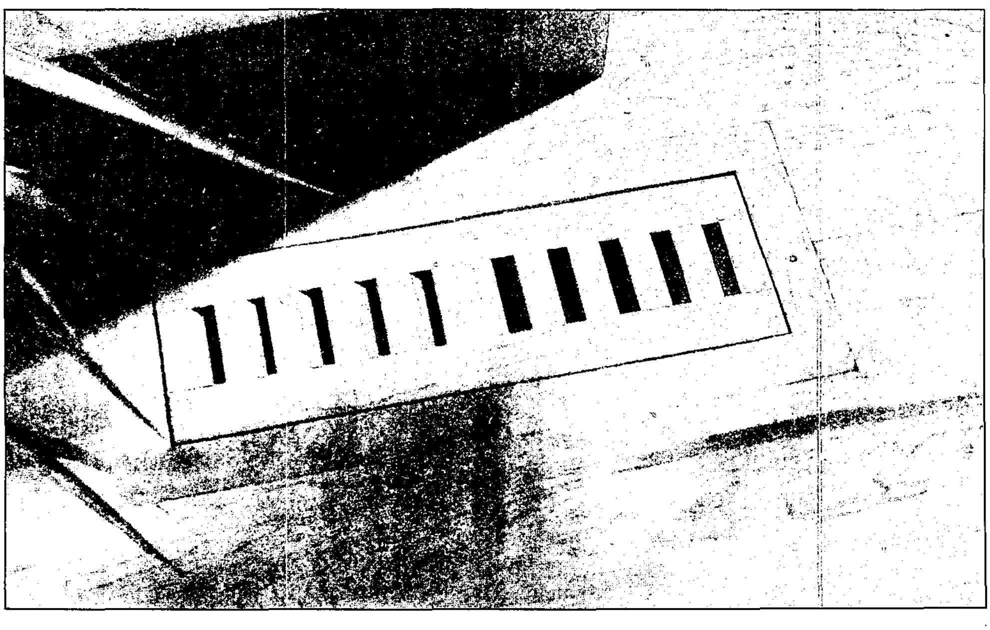
A four-page brochure from Gyp-Crete describes how finished floor goods are attached to Gyp-Crete and Gyp-Crete 2000 underlayments and provides installation guidelines, listing recommended adhesives that are to be used with various floor coverings. The underlayments are poured-in-place products that correct rough wood and concrete floors. Both products have a smooth, flat surface, which helps floor coverings last longer.

Thoro System Products has a polymer emulsion sealant called Primer 1800 that seals substrates prior to using self-leveling or trowel-grade underlayments. The primer is suitable for use over wood, tile, slate, concrete, terrazzo, and brick.

American Plywood Association
Circle 252 on information card
Randustrial Corporation
Circle 253 on information card
Gyp-Crete Corporation
Circle 254 on information card
Thoro System Products
Circle 255 on information card

Wood Floor Registers The Grill Works offers wood floor registers as an alternative to conventional metal floor registers, manufacturing them in fine hardwoods of all species. These grills can be used in both new construction and remodeling and come in 2¼x12 inches or 4x10-inch duct openings. They can also be made to specification.

Grill Works, Circle 267 on information card



Wood Construction Guidelines

Among crucial concerns in building with wood are adequate site drainage, protection during construction, and protection of metals used in conjunction with the wood. Moisture barriers, flashings, and other protective features can be used to prevent moisture from being trapped on the wood's surface, causing it to rot. Preservative treatments are always recommended when wood is fully exposed to the weather. Further information on wood construction is available in the American Institute of Timber Construction's pamphlet, "Typical Construction Details, 104-84."

A revised standard from the Hardwood Plywood Manufacturers Association, "American National Standard for Laminated Hardwood Flooring," covers grade descriptions for face, inner, and back plies of veneer; glue bond; moisture content; dimensions; packaging; inspection and test procedures; and definitions. The appendix covers installation, recommendations, and reinspection practices.

American Institute of Timber Construction
Circle 244 on information card
Hardwood Plywood Manufacturers Association
Circle 245 on information card

Ceiling Systems

Derako suspended wood ceilings from the Rulon Co., a division of CRF Industries, are installed on a patented clip and rail suspension system designed to guard against warpage, shrinkage, and movement. The ceilings can be used in an open sys-

continued on page 138

WE CALL IT THE PERSONAL ARCHITECT. NOT THE PERSONAL DRAFTSMAN.

NOW DXF COMPATIBLE

We named it on purpose. This is a tool for the entire architectural practice, combining automated design and drafting capabilities on industry-standard IBM* PC ATs and compatibles.

Use the Personal Architect to design buildings. While other systems work with lines and arcs, the Personal Architect lets you work with floors, walls, roofs, and rooms. In 3-D. In perspective. So you can create a true model of your building design.

Use the Personal Architect to present designs.

This system gives you the tools you need to make effective presentations. Like perspective views with hidden lines removed. Shaded pictures. And area takeoffs.

Use the Personal Architect to produce drawings. The system has expert drafting capability to get your production work done. And can edit drawings quickly too.

On-screen icon menus get you up and running fast. And a graphic symbol library of over 1,000 architectural symbols gives you great flexibility.

The Personal Architect. It can help you get more business and do more business. And isn't that the name of the game?

Get more business done. *On-screen menus (left screen) facilitate the production of contract documents. Drawing courtesy of Heard & Associates, Chicago, Illinois.*

Get more business. *Shaded pictures (right screen) like this help clients see your vision clearly from any perspective. An invaluable selling tool. Drawing courtesy of Stephen Douglass, Architect, Cambridge, Massachusetts.*

For more information call 1-800-248-PSBU (7728). In Massachusetts & Canada, 617-276-1094. Or write to: Computervision Corporation, PSBU, Building 16-2, 100 Crosby Drive, Bedford, MA 01730.

COMPUTERVISION
Personal Architect

*IBM is a registered trademark of International Business Machines Corp.

Products *from page 136*
tem with felt spacing, or fully closed. Removable wood strips provide above-ceiling access. The wood strips are supplied in four-inch standard or special random widths. Factory-applied felt pieces between the open strips help provide some acoustical resistance, and the strips can also be factory-processed with fire-retardant treatments.

Profilewood solid wood ceiling and wall panel systems from Ostermann & Scheiwe USA are installed with special galvanized clips inserted over the bottom lip of the groove and then fastened to furring strips with nails or staples, or the paneling can be glued with heavy-duty mastic for swifter application. Clips allow differential movement of the wood. Five kinds of wood are available in eight-foot and random-length packages containing at least two eight-foot pieces, with the balance made up of random lengths varying from one to seven feet. A maximum of two one-foot pieces is included.
Rulon Company
Circle 256 on information card
Ostermann & Scheiwe USA Inc.
Circle 257 on information card

Wood Doors
A brochure outlines a new selection of veneers for the VX line of wood doors from Forms + Surfaces. The doors are suitable for interior residential and commercial areas.

The Architectural Woodwork Institute helps architects select the right wood door through a brochure, "Architectural Flush Doors," which discusses door selection, door grades, core construction, and relative cost of prefit, prefinished, and premachined doors. Also covered are the latest fire door information, care techniques, handling, installation, and a specification checklist.

Prefinished and premachined wood doors from Cal-Wood Door, Timberland Building Products Co., are available in a wide range of wood species and are factory finished in several standard and custom finishes to meet architectural design specifications.
Forms + Surfaces
Circle 261 on information card
Architectural Woodwork Institute
Circle 262 on information card
Timberland Building Products Company
Circle 263 on information card

Wood Paneling and Molding
Redwood in tongue-and-groove patterns is popular for both paneling and siding. Available with square edges, eased edges, or a variety of V grooves, the wood comes in three architectural grades and in rustic sidings. Standard tongue-and-groove patterns come from the mill with a smooth planed face, except those designated with the suffix "R," which are reversible. These have a saw-textured surface on one face and a smooth surface on the other face. All tongue-and-groove patterns can be specially ordered with the face resawn in a saw-textured finish. Saw-textured redwood has an even appearance and color and reputedly holds finishes as long as other smooth surfaces. The California Redwood Association has a variety of booklets providing information about the use of redwood for interior applications.

Profilewood A-Plank is a solid wood, clear grade, tongue-and-groove western hemlock plank-type wall and ceiling system from Ostermann & Scheiwe USA. The wood is pressure treated with a fire-retardant product and carries a Class A UL rating. The A-Plank is milled after being pressure treated and kiln dried, and is available in either a vertical or mixed grain. A-Plank is sold unfinished, and should be used only on interior applications where high moisture conditions do not exist. A-Plank is installed with a clip system that allows the panels to expand and contract without affecting appearance, and also eliminates the necessity of nailing through the wood.

Woodcrest solid wood planks and complementary, prefinished solid red oak moldings are introduced from the commercial division of USG Interiors Inc. The Woodcrest planks feature beveled edges and come in four- and six-inch-wide modules with tongue-and-groove joinery on both sides and ends. Specially designed metal clips eliminate face nailing. Marlite solid wood planks are comprised of

No. 1, clear, ½-inch-thick red oak and come in lengths of two, four, six, and eight feet. The surface is factory finished with melamine using a heat-cured coating system and a thermo-setting synthetic resin. The back surface is relieved and finished to prevent warping. Solid oak planks are available in two styles, "Select" and the rustic "Colonial," both with beveled edge planks and in a number of varying widths and lengths.

Architectural moldings are designed to work as a system with the planking, and are delivered prefinished from the factory. Inside and outside moldings, division moldings, crown moldings, decorative quarter rounds, chair rail, base moldings, and cap moldings are available.

California Redwood Association
Circle 258 on information card
Ostermann & Scheiwe USA Inc.
Circle 259 on information card
USG Interiors Inc.
Circle 260 on information card

Fire-Retardant Treated Wood

Dricon is a fire-retardant chemical for wood from Koppers Co., patented and UL-listed for a flame-spread and smoke rating of 25 or less. Dricon also offers low moisture absorbency in environments of up to 95 percent relative humidity. Additionally, Dricon acts as a pesticide against termite attack and fungal decay when used in above-ground, weather-protected areas.

Fyreply fire-retardant hardwood paneling from Speltz Plywood Corp. has a Class A rating and contains no asbestos. Flame-spread and smoke-density tests were conducted by the Hardwood Plywood Manufacturers Association using ASTM standard E-84 for surface burning characteristics of building materials. Intended for interior use only, Fyreply is a five-ply panel constructed with a Class A mineral core, two plies of fire-barrier sheets, and hardwood face and back. Special fire-retardant adhesives make the three-ply core a Class A platform for face veneers. The paneling is ¼ inch thick and measures 48x96 inches. Other sizes are available on special order. All panels are manufactured to the standards required under "American Standard for Hardwood and Decorative Plywood," ANSI/HPMA-HP 1983.

Flame Proof LHC fire-retardant-treated wood from Osmose Wood Preserving Inc. uses a special formulation of fire-retardant chemicals developed for the pressure treatment of lumber, plywood, and other wood products. The UL-labeled retardant features a flame-spread rating of 25 or less, and has smoke-inhibiting characteristics. Flame Proof LHC is reputedly self-extinguishing, eliminating the wood as a fuel source and limiting the spread of fire.

Koppers Company Inc.
Circle 264 on information card
Speltz Plywood Corporation
Circle 265 on information card
Osmose Wood Preserving Inc.
Circle 266 on information card

Wood Coating

PPG high-performance millwork coating systems for wood are liquid coatings designed to resist chipping, peeling, and chemical and ultraviolet deterioration. Offering flexibility and adhesion to many wood species, the polyurea coating is available in white with both semigloss and gloss finishes. Other coatings may be specified.

PPG Industries
Circle 268 on information card

Wood Flooring Maintenance

Harris-Tarkett's nonsolvent hardwood flooring products are designed to remove sticky food substances, rubber heel marks, and other foreign substances such as grease and crayon from floors with either a waxed or Swedish polyurethane finish. The Crystal Clear Wood Floor polish is formulated for wax finishes, and for Swedish finish floors, a Crystal Clear Wood Floor Touch-Up is available.

Harris-Tarkett
Circle 269 on information card

NEW AND NOTEWORTHY

Visual Smoke Alarms

Two audible/visible smoke alarm systems are designed exclusively for the hearing impaired. The portable Strobe-Alarm combines a UL-listed photoelectronic smoke detector with a UL-listed strobe light and fire sign, which is said to be the most effec-

continued on page 140

Products *from page 139*

tive and highest intensity strobe beacon of its size. The VSA strobe meets the photometric requirements outlined by NFPA 72G-Installation Guidelines for Protective Signaling Systems. The Strobe-Alarm can hang on any wall and can plug into a standard wall outlet up to eight feet away. Both the smoke detector and flashing strobe are contained in a finished wood housing. The Model SD/VSA provides the same performance as the portable alarm but is hard-wired to buildings. A continuous visual test of the smoke detector is provided by an LED indicator on the front of the detector that flashes once every four seconds during normal conditions to indicate that the unit is operational. When smoke is sensed the LED emits a steady light. Manual testing is provided by a test button on front of the alarm. The smoke alarm resets automatically when the smoke condition clears or when the test button is released.
Whelen Engineering Company Inc.
Circle 267 on information card

CADD Guidelines

Choosing a CADD system has never been more difficult. The anticipated merger of functions until all programs do the same things in the same way hasn't happened. Instead, new programs keep introducing new ways of aiding design, which, in turn, challenge the existing programs to improve in their own way or be passed by.

	Arris	Drawbase	Fastcad	Microstation	Ultracadd Plus
First sale (PC)	1986	1986	1986	1986	1987
Installations (PC)	450	600	3,000	3,000	100
Version evaluated	5.5.1	1.04	1.1	2.1.3	4.2a/2.2a
Price as shown	$6,500	$5,000	$2,295	$3,000	$2,950
Modules available	yes	yes	no	no	yes
Other options	$2,000	no	no	no	
800 support number	no	yes	no	no	yes
Tech support	Dealers	$50/mo.	Free	Free	Dealers
Demo version	no	$50	$20	Free	$175
Use protected	yes	yes	no	yes	no
Size of program	8.5MB	1.2MB	100KB	2.5MB	540KB
Operating system	Xenix	DOS	DOS	DOS	DOS
Word length (bits)	32	16	32	32	16
Data format	integer	FP	FP	integer	FP
3-D	yes	yes	no	yes	yes
Hidden line removal	yes	yes	no	no	yes
Light sources	6	no	no	no	no
Shading	yes	yes	no	no	yes
Auto-save routine	yes	no	no	yes	no
Undo command	yes	yes	yes	no	yes
Network	yes	no	yes	yes	no
Split screen	yes	no	yes	yes	yes
Dual screen	no	optional	no	optional	optional
Orientation	mouse	digitizer	mouse	digitizer	mouse
Symbol library	yes	yes	no	no	$500
Built-in fonts	7	6	2	10	1
Evaluator					
Lyman	1	2	3	3	4
Hjertstedt	1	2	3	5	4
Dieckmann	2	1	3	3	3
Harriman	2	1	3	4	4
Voosen	3	4	1	5	2
Zinni	2	1	5	4	3
Cappozzo	1	2	5	4	3
Montgomery	2	3	4	1	5
Campbell	2	1	4	5	2
Engelke	1	2	5	4	3

Highlighting indicates the program assigned to each architect.

The five new programs discussed in the article beginning on page 103 present some concerns worthy of consideration by anyone shopping for a new CADD system. (Addresses of the five manufacturers are given below.)

Some characteristics to look at are the history of the program's development, the equipment it runs on including peripherals, the copyright protection devices, the applicability of the program to architecture (as opposed to automotive design, for example), and the scope of third-party software support.

Some that were important topics last year are becoming moot, such as 3D versus 2D. Most serious competitors offer 3D, although a program's ability to take a drawing from 2D to 3D and back again is still an impressive presentation. Integer versus floating point math is also fading as a sales feature, reports Oliver Witte.

Other decisions to be made are the cost-factored merits of 80386 versus 80286 microprocessors; system compatibility, especially regarding graphics card flexibility and capability; and whether the program best supports the shopper's preference for a mouse or a digitizer. Of course, price, power, and ease of installation remain key points for consideration when shopping for a program.

The upper table, facing page, summarizes important characteristics of each system. The lower table shows how the evaluators compared the five programs. They ranked the programs solely on the value to their own firms, and it is not helpful to add up the scores to determine a winner. "One" connotes most valuable and "five" is least valuable.

Arris, by Sigma Design, 61 Inverness Dr. East, Englewood, Colo. 80112, phone (303) 790-9080.

Drawbase, by Skok Systems, 222 Third St., Cambridge, Mass. 02142, phone (800) 225-7565 or (617) 868-6003.

Fastcad, by Evolution Computing, Suite 106, 437 S. 48th St., Tempe, Ariz. 85281, phone (602) 967-8633.

Microstation, by Intergraph, 1 Madison Industrial Park, Huntsville, Ala. 35807, phone (800) 345-4856. In Alabama, call (800) 345-0218.

Ultracadd Plus, by Maxam Technologies, 15215 Shady Grove Rd., Rockville, Md. 20850, phone (800) 556-2926 or (301) 330-7200.

CREDITS

Kenyon College, Gambier, Ohio (page 78). *Architect: Shepley Bulfinch Richardson & Abbott, Boston.* Principal in charge: Geoffrey Freeman, AIA. Project designers: Paul Sun, FAIA, and Ray Warburton, AIA. Project architect: Jon Ross, AIA. Mechanical, electrical, plumbing, and fire protection: Heapy Engineering. Structural engineer: LEA Group. Construction manager and general contractor: Albert M. Higley Co. Interiors, graphics, and landscape: Shepley Bulfinch Richardson & Abbott. Mechanical contractors: Weithman Bros., Julian Speer & Co. Electrical contractor: Bellville Electric Co.

Amherst College, Amherst, Mass. (page 82). *Architect: Perry, Dean, Rogers & Partners, Boston.* Steven M. Foote, AIA, partner in charge in collaboration with Charles Rogers II, AIA. Project architect: David Fixler. Project designer: Martha Pilgreen. Design team: Jeff Heyne, Bruce Hutt, David Krawitz, Edward Polk. Structural engineer: Boston Building Consultants. Mechanical and electrical engineer: BR&A Inc. Plumbing engineer: R.W. Sullivan Inc.

Illinois Housing Development Authority, Chicago (page 129). *Architect: Booth/Hansen & Associates, Chicago.* Design partner: Laurence Booth, FAIA. Managing partner: Paul Hansen, AIA. Director of interiors: Catherine Benson. Project architect: John Shuttleworth.

Centra Advertising Co., St. Louis (page 130). *Architect: The Lawrence Group Inc., St. Louis.* Principal in charge of design: Stephen A. Smith. Design team: Patrick Nolan, Mark O'Bryan. Interior designer: Linda Loewenstein. Mechanical and electrical engineer: HPI Engineering. Structural engineer: McGinnis & Associates. General contractor: Renovation Concepts. □

MAIN OFFICE
1735 New York Avenue N.W.
Washington, D.C. 20006
(202) 626-7300

James P. Cramer
Group Publisher
Michael J. Davin
National Sales Manager
Jesse Sims
Production Manager
Cynthia Kellar Duck
Assistant Production Manager
Bernard F. Kroeger
Circulation Manager
Brenda L. Owens
Assistant Circulation Manager
Carol Kavanaugh
Circulation Assistant
Nancy Perri
Assistant to the Publisher
Bob Kliesch
Publisher

ADVERTISING SALES OFFICES
New York/Connecticut (215) 254-9800
Michael J. Davin, National Sales Manager
995 Old Eagle School Rd., Suite 301
Wayne, Pa. 19087
New England (404) 980-6740
James A. Bauschka
6520 Powers Ferry Rd., Suite 200
Atlanta, Ga. 30339
Philadelphia/Pittsburgh (215) 254-9800
George T. Broskey, Eastern Sales Manager
995 Old Eagle School Rd., Suite 301
Wayne, Pa. 19087
Southeast (404) 980-6740
James A. Bauschka
6520 Powers Ferry Rd., Suite 200
Atlanta, Ga. 30339
Midwest (312) 527-1055
Jack E. Bergren
Barbara Mitchel
1337 The Merchandise Mart
Chicago, Ill. 60654
Jack E. Bergren (414) 786-4286
2530 Coach House Dr.
Brookfield (Milwaukee) Wi. 53005
Southwest (314) 569-3210
Richard Grater
1466 Summerhaven
St. Louis, Mo. 63146
West/Northwest (619) 450-6462
James A. Anderson
5830 Oberlin Dr., Suite 300
San Diego, Calif. 92121
Europe 0211-65-2031
Erich Hillerbrand
Media + Marketing Services
Eitelstrasse 32
4000 Dusseldorf 30
West Germany

Did you miss valuable information offered by advertisers in January's issue of ARCHITECTURE?

The manufacturers listed below were advertisers in last month's issue who are anxious to provide you with their latest product information and literature for your planning needs. To receive this helpful information, just circle the appropriate numbers on the adjacent self-addressed, postage-paid response card.

AIAS. A call for entries to participate in the Spring '88 National Student Design Competition, "The Fourth Perspective." *Circle No. 150*

American Standard Inc. Introducing our dramatic new line. Send today to find out how successful The Line™ can be for you. *Circle No. 151*

AT&T. Premises Distribution System: a single wiring system that meets all your clients communications needs. Send today for more information. *Circle No. 152*

Commonwealth Aluminum. Cammcat™ Flurodize® Coil, the new surface anodized can't match. Send today for more information. *Circle No. 153*

CPG/Clearprint. When it comes to reproducing an original, you'll have to go to great lengths to beat the quality of Clearprint EE vellum for electrostatic copiers. *Circle No. 154*

Cupples Products. Send for more information on how to put 40 years of experience in custom curtain-wall solutions to work on your next curtain-wall project. *Circle No. 155*

Curries Manufacturing Inc. Curries offers hollow metal doors in more choices in face skins, sizes, colors, grades, types, and configurations than anybody else. *Circle No. 156*

Du Pont Co.-Imaging Systems. Send today for more information on new Du Pont Silver Slicks: a cost-competitive alternative to diazo, with superior image quality. *Circle No. 157*

EFCO. There's no secret to finding a high-performance Ribbon Window System with totally hidden mullions. Send today for more information. *Circle No. 158*

Fry Reglet. Fry's Aluminum Architectural Moldings add a third dimension to your designs. Send today for more information. *Circle No. 159*

Grace, W. R. A simple test for slope-to-drain proves only NVS™ roof insulation makes the grade. Send for more information. *Circle No. 160*

Haven-Busch Co. The Cirkel-Line Entrance brings entryway design to the threshold of a new era. Send today for a free brochure. *Circle No. 161*

H.W.H. Corp. EKKI hardwood timbers have the characteristics you associate with steel and concrete, strength and durability, along with the enduring beauty of natural hardwood. *Circle No. 162*

ISICAD. Design systems for the real world. Send today for more information on how ISICAD can meet your design requirements. *Circle No. 163*

J. P. Stevens. Introducing the Stevens Hi-Tuff Plus™ Total Roofing System. Send for more information. *Circle No. 164*

Kalwall Corp. The most highly insulating, light transmitting composite systems for walls, window-walls, skyroofs and window replacement. *Circle No. 165*

Kawneer Co. Inc. Crystaline is the total Entrance and Framing System no matter how you look at it. Send for product information today. *Circle No. 166*

Keuffel & Esser Co. Crystalene® Prepared Tracing Paper beats the competition to the draw. Send today for more information. *Circle No. 167*

LCN Closers. Send for more information about the LCN Auto-Equalizer and other closers designed to solve entrance accessibility problems. *Circle No. 168*

Manville Roofing. For a roof system that performs the way its supposed to right from the start, come to the company with over 130 years experience. *Circle No. 169*

Monier. Rise above the crowd with the new Signature Tile Series roof tiles by Monier. Send today for more information. *Circle No. 170*

Nucor. Send today for more information about Vulcraft steel joists, joist girders, and steel deck. *Circle No. 171*

Pittsburgh Corning Corp. A call for entries: Let your imagination soar with the PC Glass Block Architectural Design Awards Competition. *Circle No. 172*

Polyurethane Foam Contractors. A modern, seamless, sprayed polyurethane foam roof stops leaks, installs fast, and is economical and easy to maintain. Send for more information. *Circle No. 173*

Schlage Lock Co. A name synonymous with quality and durability for over 60 years. Send today for the Architectural Guide to Door Hardware. *Circle No. 174*

Spectrum Glass. Thermopane® insulating glass has provided clear solutions to widely differing technical problems for decades. *Circle No. 175*

Spectrum Glass. Offers a wide array of high performance glass products that could be instrumental to resolving your fenestration problems. *Circle No. 176*

Spectrum Glass. When your design calls for high-performance solar control glass, specify Vari-Ran® metallic coating from Spectrum. *Circle No. 177*

Spectrum Glass. Specialists in fabricating high-performance glass for construction. Send today for more information. *Circle No. 178*

Steelcraft. Another First. Over 2,450 square inches of glass now permitted in Steelcraft® UL®-Listed frame. Send today for more information. *Circle No. 179*

Stucco Stone Products. With lightweight Cultured Stone® you can achieve the beauty of natural stone at a fraction of the cost. *Circle No. 180*

Suffolk County Vietnam Veterans Memorial Commission. An open competition to design a unique and lasting memorial to all Vietnam veterans. *Circle No. 181*

Tamko. The leading force in modified asphalt roofing research and technology. Send today to learn more about our products. *Circle No. 182*

Trans National Travel. Send today for more information on the great travel buys the AIA Travel Service has to offer and receive a free copy of the AIA 1988 World Vacations Guide. *Circle No. 183*

Union Carbide Corp. Our MOLSIV® Series 2000 is the broadest line of desiccants developed and manufactured exclusively for use in insulating glass units. *Circle No. 184*

Velux America. Send for a free copy of "The Complete Guide to Roof Windows and Skylights." *Circle No. 185*

Vistawall Architectural Products. Vistawall Curtain Wall Systems provide you with the elements to make your most innovative design a reality. *Circle No. 186*

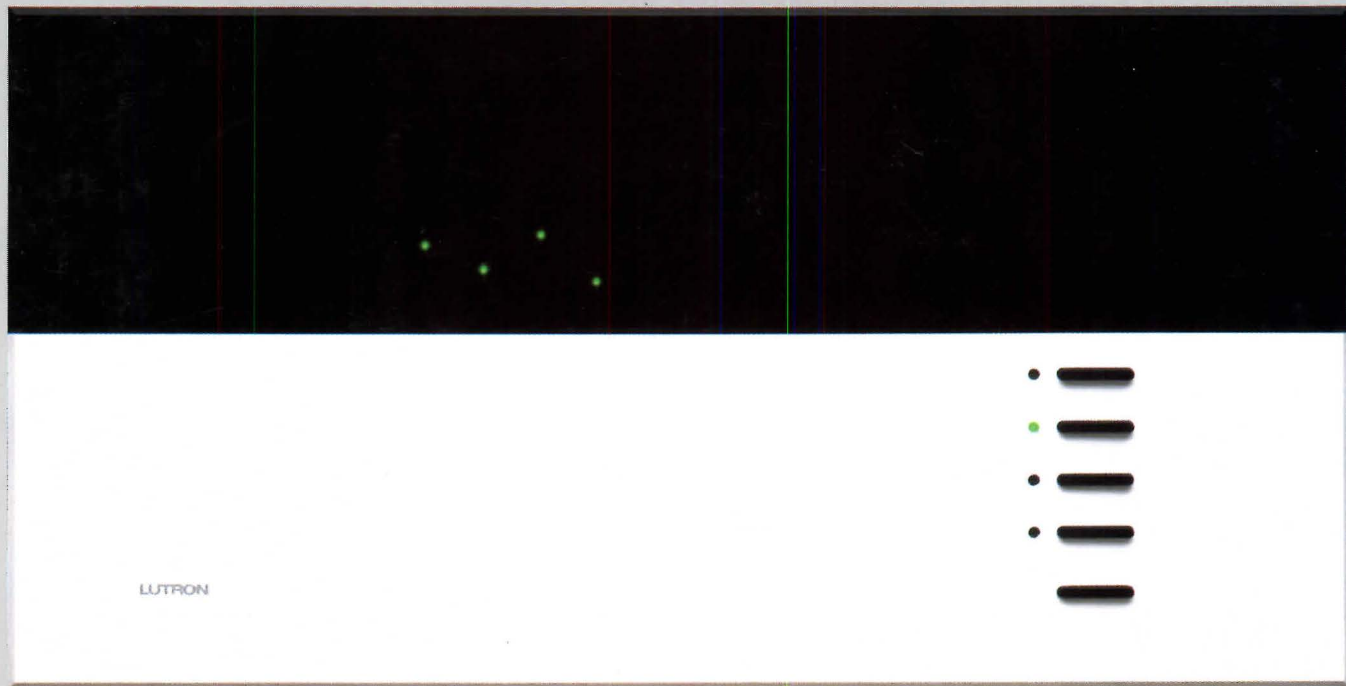
For product information and literature from advertisers in this issue of Architecture, circle appropriate numbers on advertisements.


RADII,
THE DESIGNER'S
WATER COOLER. BY OASIS,
OF COURSE.
When anything less won't fit your design, there's Radii. It's the bi-level water cooler that delivers 8 GPH of chilled drinking water for the general public as well as the handicapped. You'll find a full line of Oasis® Radii water coolers and fountains—designed to fit your design.
See your Sweet's or Hutton Files for details. Or your nearest Oasis distributor. He's listed in the Yellow Pages. Ebco Manufacturing Co., 265 N. Hamilton Road, Columbus, Ohio 43213-0150.
OASIS
WATER COOLERS BUILT WITHOUT SHORTCUTS.
Northwestern Atrium Center
developed by
Tishman Midwest Management Corp.
Chicago, Illinois
Architect: Helmut Jahn

Introducing

GRAFIK Eye™

4-Scene, 4-Zone Preset Dimming Control



GRAFIK Eye Control—Preset dimming with a sleek, thin profile design

Create 4 Distinct Lighting Scenes... Recall Each by Touching a Button

The GRAFIK Eye Preset Dimming Control offers:

- coordinated lighting control in one sleek, thin profile unit.
- control of 4 independent lighting zones (circuits) which create 4 distinct lighting scenes.
- the ability to transform the lighting of any space with the simple touch of a button.

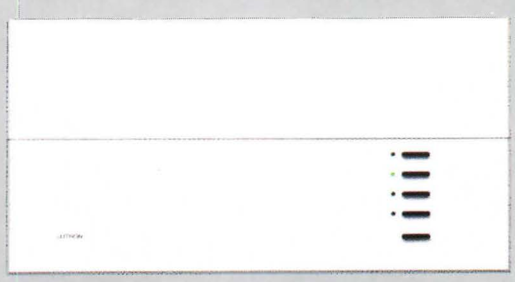
The GRAFIK Eye Control can:

- provide proper lighting levels for multiple functions.
- emphasize unique features that have been designed for the space.
- create different moods or ambiance.

The GRAFIK Eye unit controls up to **2000 watts*** of incandescent, incandescent low voltage, and fluorescent lighting.

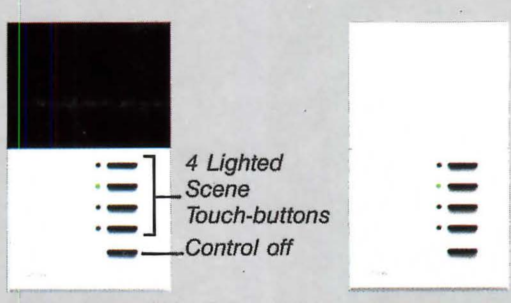
* For applications requiring more than 2000W/VA total load, consult the Lutron Hotline.

Circle 128 on information card



GRAFIK Eye Control with white opaque cover
Dimensions: .295" thin x 8⅞" x 4½"

Thin profile



Auxiliary Scene Activators provide remote touch-button control from 1 or 2 additional locations. Available with smoked translucent cover and white opaque cover

Dimensions: .295" thin x 2¾" x 4½"

For more information on the GRAFIK Eye Preset Dimming Control, call Lutron's Hotline toll-free:
(800) 523-9466 (U.S.A.)
(800) 222-4509 (Pennsylvania)

LUTRON®

Lutron Electronics Co.,Inc.
205 Suter Road
Coopersburg, PA 18036 U.S.A.