Introducing a new wrinkle in ceilings

Corrugated Crossgate introduces a striking ribbed look to acoustical ceiling design. Available in four neutral colors, this 2’x2’ panel fits into narrow, ¾” Suprafine® grid. The corrugated design adds a new dimension.
REPUTATIONS AREN'T BUILT IN A DAY.

For over half a century, we've built our reputation building reputations.

Olympic® protects more than wood. We protect reputations, whether you're an architect, builder, property manager or painter.

We've always brought you products made from the finest raw materials under strict quality control. Year after year, project after project. Which is one reason why Olympic protects more homes than any other stain.

In addition to excellent products, we offer you a support team dedicated to excellence.

The Olympic Stain Professional Team brings you personal service and technical assistance like property inspections, complete color design and coordination, product consulting and experienced bid counseling.

We know you've spent a long time building your reputation.

We can help protect it for a very long time.

OLYMPIC STAIN.

We've been protecting the American Dream for over half a century.

Circle 4 on information card
Technology and Practice

**Mexico City as Seismic Laboratory**
A multinational team draws lessons from the 1985 tragedy.
By Donald E. Geis and Christopher Arnold, AIA

**Neighborhoods Rise from the Rubble**
Mexico City's remarkable housing reconstruction program.
By Anne Ferrebee and Eduardo Terrazas

**Chinese City Starts Over After Quake**
Totally leveled, Tangshan is replanned as well as rebuilt.
By Christopher Arnold, AIA, and Henry Lagorio, AIA.

**The Coming Changes in Earthquake Codes**
They will require sharp changes in designers' thinking.
By Delbert B. Ward

**Failures Short of Complete Collapse**
Their causes and prevention. By Elena Marcheso Moreno

**CADD on the Cheap Using PCs**
Surveys show it growing in favor.
By Elizabeth J. Macklin, AIA
CONTENTS

Five Volumes Strung Along a Hillside
House in Tesuque, N.M., Antoine Predock, FAIA.
By Allen Freeman

Highly Sophisticated 'Cabin in the Woods'
House in Door County, Wis., Hammond Beeby & Babka.
By Lynn Nesmith

'Miniaturized, Fairy-Tale Castle'
House on the Severn River, Md., Bohlin Powell Larkin
Cywinski. By Andrea Oppenheimer Dean

Elaboration of Regional Building and Craft
House near Houston, Clovis Heimsath Architects.
By Allen Freeman

Architectural Jazz and Solar Ingenuity
House in a Washington, D.C., suburb, Jersey Devil.
By Michael J. Crosbie

Meeting of Two Cultures in a Model Home
Designed by Californian Steven D. Ehrlich, AIA, for a
Tokyo housing exhibition. By Hiroshi Watanabe

'Tiny, Amiable' Gate House
For a Woodstock, N.Y., estate, Kliment & Halsband.
By Andrea Oppenheimer Dean

Housing for the Poor: Losing More than We Build
So far no real substitute has been found for a positive
federal role. By Nora Richter Greer

New York's First, and Perhaps Best, Public Housing
Harlem River Houses celebrates its 50th birthday.
By Allen Freeman

Donald Canty, Hon. AIA, Editor in Chief
Carole J. Palmer Andrea Oppenheimer Dean Allen Freeman
Executive Art Director Executive Editor Managing Editor
Nora Richter Greer, Michael J. Crosbie, Lynn Nesmith, Sharon Lee Ryder,
Forrest Wilson, Senior Editors; Douglas E. Gordon, M. Stephanie Stubbs,
Elena Marcheso Moreno, Technical Editors; Karen Collins, Amy Gray
Light, Assistant Editors; Elizabeth Dahlslie, Copy Editor
David P. Schaap, Design Assistant; Timothy B. McDonald, Technical
Illustrator
Robert Campbell, AIA, David Dillon, Robert A. Ivy Jr., AIA, John Pastier,
Bea Sennewald, AIA, Karen Haas Smith, Marguerite Villecco, Oliver
R. Witte, Contributing Editors
Bernard F. Kroeger, Circulation Manager; Brenda L. Owens, Assistant
Circulation Manager; Jesse Sims, Production Manager; Cynthia Duck,
Assistant Production Manager; Nancy Perri, Assistant to the Publisher
Bob Kiesche, Publisher

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: $39 for one year, $53 for two years, $70 for three years.
Canada: $41 for one year, $63 for two years, $80 for three years. Foreign: $59 for one
year, $101 for two years, $143 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. © 1987
by The American Institute of Architects. Opinions expressed by the editors and
contributors are not necessarily those of AIA. The drawings, tables, data and other
information in ARCHITECTURE have been obtained from many sources, including
government organizations, trade associations, suppliers of building materials, and
professional architects or architectural firms. The American Institute of Architects
has made every reasonable effort to provide accurate and authoritative information,
but does not warrant, and assumes no liability for, the accuracy or completeness of
the text or its fitness for any particular purpose. Vol. 76, No. 7.
Give your space the cutting edge.

Take a good look at our new Second Look®/Bull-Nose acoustical ceiling. You'll see an edge so sharp in detail, it cuts through the clutter of commodity ceilings.

Sophisticated edge detailing and surface scoring present upgrade possibilities at a moderate price. Free of acoustical punches, the \(\frac{9}{16}''\) score lines integrate with – and disguise – our Suprafine® grid.

On the practical side, the bull-nose design reduces edge damage during installation and maintenance. And 2' x 4' lay-in panels afford easy access and lower installed costs.

So give your space the cutting edge. For a brochure, call 1 800 233-3823 and ask for Second Look/Bull-Nose.

Armstrong

Circle 3 on information card
EVENTS


Aug. 29-30: Louis Sullivan Architectural Symposium, Cedar Rapids, Iowa. Contact: David Wendell, Louis Sullivan Symposium, P.O. Box 396, COE College, Cedar Rapids, Iowa 52402.

LETTERS

Buildings and Sites: Three projects noted in your May issue graphically illustrate the contrast between architecture that is "of a place rather than on it" and the converse.

Charleston Architectural Group's Middleton Inn [page 166] is so carefully sited within its "Low-Country forest" and meticulously detailed that its modernist design is at home with its environs. SOM's National Commercial Bank [page 170] in Jeddah, by contrast, is so totally non-contextual that it appears as a college-level, basic design Strathmore model. Finally, Fisher-Friedman Associates' Vintage Club [page 98] sits in a man-made lake in country where all water is stolen from the Colorado River by means of aqueducts. In this instance, at some cost to the environment, the architect has created a place to be of/on.

James T. Biehle, AIA
St. Louis

Why N.C.B. in Jeddah is Not a Triangular Building: The enclosed diagram [below], while it is after the fact (like all diagrams), illustrates the relation of the plan of the National Commercial Bank to the conventional office building. [See May, page 170.] The primary fact about the design of N.C.B. is that it was not designed in elevation, but in plan. It is a building made by stacking vee-shaped plans, which were rotated every seven floors. It is a series of rotated vees with a triangular base and cap. The fact that one of the atriums has nine floors rather than seven was in response to a client request to have more floors where the atrium faced the view north. Of course if we had not liked this we would have resisted, but the point is it was the result of his request.

Only after the building was planned was it studied in elevation to determine how to handle the fenestration at the executive floor at the top. The canopy and garage were also studied in elevation.

The well in the center, which all the writers on the building insist was for ventilation, is in fact a product of the geometry of the floor plan, i.e., it is the void left when the vees are rotated. Again we accepted this because we liked it, and of course we realized it would be good from a ventilation point of view, but this is after the fact. From our point of view the great benefit of this well is it permits you to see through the building (unfortunately our photographer did not accept our suggestion to photograph this aspect).

Why do I insist upon these distinctions? N.C.B.'s completion and publication has coincided with the much touted "death of postmodernism." N.C.B. has been frequently cited for its having been designed on the basis of principles, not pastiche. This observation is correct, but by emphasizing the perception of the building as a triangular mass with the atriums "scooped out," the planning principle is missed.

To explain my involvement in this, I was the senior designer working with Gordon Bunshaft, FAIA. It occurs to me that for more information about our project, the Museum of Modern Art publication by Arthur Drexler about this project (as well as projects of Foster and Johnson) gives a good account, illustrated with an early study of mine for a building with no separate core and vees facing in all three directions, which was the initial idea, with sections, of which we drew many, and two elevations of mine drawn quite late in the design—after we had settled on the top but were still studying the canopy, which is on a separate piece of paper.

Still, I don't want to appear ungrateful. We are pleased with the AIA's honoring us with an award and with your publishing it.

Tom Killian
New York City

Fees and Creativity: Your article "Architects as Technological Innovators" [March, page 102] perceptively examines current technical stagnation in architecture. Given technology's logarithmic advance, materials and methods more than a few years old can needlessly restrain creativity and increase life-cycle costs.

The real issue is economic. Typical fees provide little room for new approaches. Consciously or not, architects have gradually compromised their ability to innovate as they have reduced their roles elsewhere in the building process by working for ever-smaller fees.

That architects must be more assertive in fee negotiations is reinforced in this context. Suitable fees will ensure that our responsibilities to serve clients' best interests, which may involve use of new materials and techniques, are recognized as essential to the state of the art of architecture, will not stay unfilled.

Jeffrey R. Vandervoort
Houston

Amplifications: The March article "Fabric Covers a Multitude of Buildings" (page 87), which named major players in the fabric-structure industry, failed to mention Caldwell Commercial Inc., a manufacturer of patented silicone-coated glass fiber.

Aragon, the firm that designed the Miami house shown on pages 64-67 of our April issue, is alive and well in Washington, D.C. John Ames Steffian, AIA, a principal in the firm, is now dean of the school of architecture at the University of Maryland.

The project manager for the Colby College Student Center, by Centerbrook Architects (May, page 108), was J. Whitney Huber, AIA. The design team included James A. Coan, AIA, Robert Coolidge, AIA, David Hajian, Elaine Lary, Roger Williams, and Randal Wilmot.
Meier Wins Commission After
Competition Jury Chooses Koolhaas

After an unusual selection process, Richard Meier & Partners of New York City has won the commission to design the new city hall complex in The Hague, Netherlands.

Meier was awarded the commission for the 80,000-square-foot political and cultural complex, to be located on a prominent site in the heart of the city, after the city council voted in his favor 35 to 9. City council approval came after an international design competition, an exhibition with a public vote, and a decision by the board of city fathers—which provided conflicting recommendations.

The invited design competition held in the early spring was won by Rem Koolhaas of the Office for Metropolitan Architecture in Rotterdam. His scheme was selected over proposals by Helmut Jahn, FAIA, of Murphy/Jahn of Chicago; a team headed by Roger Saubot and Francois Jullien of Paris with the Webb Zerafa Menkes Housden Partnership of Toronto; Hans Boot of Van den Broek en Bakema of Holland; and Meier. (Koolhaas was invited to join the competition after James Stirling, Hon. FAIA, withdrew six weeks before the proposals were due.)

After the jury recommendation, the five proposals were exhibited and visitors to the show were polled. Meier won the public vote. However, the eight-member board of city fathers was split between Koolhaas and Meier and the decision devolved to the city council.

Meier's scheme (below) has two 10-story wings connected by a large, glass-covered atrium and responds to the rounded end of the narrow, wedged-shaped site. In addition to a new city hall, the $100 million (or more) complex will include related municipal facilities, a library, and a commercial office building. In commenting on his design, Meier said, "The character and spirit of the building is defined and evoked by its architecture, by the way in which light and space are treated, not by superimposed preconceived symbols of government."

The discord surrounding the selection of Meier's scheme is the latest chapter in the ongoing saga to find an appropriate use for the downtown site, which began in 1909 when a new city hall was first proposed. After numerous proposals and a series of design competitions for the site, a city hall complex on the outskirts of the city was built beginning in the 1930s. If all goes as planned, the new municipal complex will serve as a catalyst for revitalizing the downtown neighborhood, and the existing government complex in the suburbs will be replaced by a 800-unit, middle-income apartment project by Ricardo Bofill.—LYNN NESMITH

Graves's Whitney Addition Debated at Landmarks Hearing

Museum officials, architects, attorneys, architectural historians, and preservationists gathered in late May at a day-long hearing before the New York City Landmarks Preservation Commission to decide the fate of a proposed addition to Marcel Breuer's Whitney Museum of American Art (see April, page 20.)

The most outspoken critics of the expansion scheme argued that Michael Graves's inflated scale is inappropriate and that the addition obliterates the architectural significance of the 1966 Breuer building. However, the final decision on the proposed addition might depend not so much on the esthetic assessment of the Graves scheme or even the impact on the original Breuer museum, but rather on the question of razing a row of brownstones along Madison Avenue and whether their destruction would set a precedent for gradual disintegration of historic districts throughout the city.

The audience appeared to be split between proponents of the expansion and critics who believed the addition would overwhelm Breuer's only building in Manhattan. While a few preservationists argued to save both Breuer and the brownstones, it was the commissioners who focused on the issue of the row houses.

Graves's original scheme, unveiled in May 1985, was met with community and media criticism, prompting museum officials to send Graves back to the drawing board. The revised plan, announced in March of this year, proposes a reddish
continued on page 16
Design from page 15

granite component south of Breuer's dark gray granite building and of equal height. The two sections, connected by a cylindrical granite hinge, would serve as the base for a three-story, set-back crown clad in light pink granite. The new scheme has been reduced by $47 feet in height and more than 30,000 square feet, and the hinge has been scaled down.

At the hearing, Graves talked about his design intentions, programmatic requirements, materials, the eclectic vibrancy of the avenue, and his goal to “make one institution—one Whitney.”

One of the first speakers, William Woodside, chief executive of the Whitney, said that a year and a half ago Graves was asked to rethink the entire Whitney and he delivered a “smaller and compact design that admirably fulfills the requirement for expanding exhibition space.” He praised the design for complementing the “powerful Breuer building.”

The expansion proposal must go through the rigorous review process of the landmarks commission because the site on Madison Avenue between 74th and 75th streets is within the Upper East Side Historic District, which gives the 21-year-old museum and the row of brownstones designed and built by Silas M. Willcox in the late 1870s the same protection as individual landmark buildings. Four of the five brownstones have been classified as “neo-Grec styled buildings” that contribute to the overall quality of the historic district, while Breuer’s museum is deemed a “styled modern building.” Each would require a “certificate of appropriateness” from the commission before being destroyed or altered.

Terrance R. Williams, AIA, who prepared a historical report for the Whitney, questioned the importance of saving the brownstones, which are so “deteriorated and compromised that they contribute little” to the character of the historic district. “I don’t think saving these buildings serves any historic purpose,” he said.

After William’s formal presentation, Anthony M. Tung said that, during his eight years and 2,553 review applications, the landmarks commission has never approved a demolition permit for a contributing building in a historic district. “Are these buildings a special case and deserve to be demolished?” he asked.

A “certificate of appropriateness” for the demolition—as opposed to economic hardship—could have repercussions for future historic districts. Tung expressed a fear that if the permit was approved “30 percent of all owners of historic buildings, either marginal or semi-contributing, will apply tomorrow for ‘certificates of appropriateness’ for demolition.”

Standing by his original statement, Williams said, “Even if the original detailing on these buildings was existing, they are not an endangered species.”

When Graves was asked if he consid-
SEE THE WORLD, NOT THE MULLIONS!

The Unique POLARPANE® I/ST™ System
True Butt Glazing With Insulating Glass

POLARPANE® I/ST™ is a unique design alternative to conventional structural glazing systems, without interior or exterior vertical mullions. Continuous strips of horizontal insulating glass for straight runs or variable angle corners are installed or replaced from the interior to save time and money. This eye-catching fully compatible, mullionless, window system is available in unlimited combinations of glass and coatings.

Hordis POLARPANE® I/ST™ units have a two-inch dead airspace between lites to improve thermal insulation and decrease sound transmission to levels consistently better than those possible with thinner airspaces—delivered complete with glass units, gaskets, metal and accessories.

AT LAST, a True Butt Glazing Window System for Insulating Glass providing maximum vision area for seeing the world, not the mullions.

For more information contact:
POLARPANE® I/ST™ Project Manager, Hordis Brothers, Inc.,
825 Hylton Road, Pennsauken, NJ 08110, 609-662-0400,
TWX 710-892-1814.

POLARPANE® I/ST™ is covered by U.S. and Foreign patents.
J. Paul Getty Museum Unveils Preliminary Scheme by Meier

Los Angeles has gotten its first tantalizing glimpse of Richard Meier's work on the J. Paul Getty Center, the future headquar ters of the world's richest and possibly most secretive arts institution. When built in 1993, the center will be a 1.45-million-square-foot complex on a 110-acre site, containing a major museum as well as six other Getty operating entities and garage space for 1,550 cars.

The mid-May presentation of a six-foot-long model (right) to the Los Angeles City Planning Department showed an interesting and, for Meier, somewhat atypical arrangement of highly articulated building masses strung out along a high ridge in the affluent single-family residential section of Brentwood. However, the presentation concealed as much as it revealed and seemed to be a well-turned move in a chess game rather than a full statement of Meier's design intentions or even of the building's real relation to its context.

The occasion for the presentation was a public hearing to determine compliance with a 107-point conditional-use zoning permit granted to the Getty two years ago. It was preceded by private presentations to members of the architectural press and, in some cases, a request to attend the hearing and cheer the scheme on. While the press was encouraged to express its approval, Meier and Getty representatives stressed that the design was still preliminary, even after at least five schemes and two years' work. They said that there were no larger-scaled working models (the presentation model was at a 1:100 scale) to provide a better idea of the forms and spaces of the project.

The model, though meticulously executed, was also of limited value in depicting the project's relationship to its surroundings. The houses that adjoin the property were left off, the buildings of neighboring Loyola Marymount University were represented in an unconvincingly crude way, and the circular tower of the nearby Holiday Inn was shown about 65 percent larger than actual size. And in its press release, the Getty gave the area of the center as 505,000 square feet, a narrowly defined net figure that was barely a third of the gross. All these details, of course, would tend to make the center itself seem smaller and less obtrusive than it actually will be.

It is difficult to understand why the institution felt it necessary to employ such tactics, for Meier's design, as far as can be determined from the presentation materials, is quite promising, and Emmet Wemple's landscape design is sympathetic and complementary to it. Perhaps there was a provision in J. Paul Getty's will that the Getty conduct its affairs with the same eccentricity and intrigue that marked his own life. Whatever the reason, the Getty by now has a long history of being less than sensitive to all its public obligations. When the original museum was built in Malibu, it was allowed to operate with inadequate parking because the city agreed to classify it as a single-family residence. Its director dismissed inquiries about its cost as irrelevant. (Even now, a project likely to cost between $200 million and $300 million is coyly referred to by museum officials as "$100 million plus."

The present mountainous site is isolated from the city fabric and not served by public transportation. It was acquired in an unannounced transaction from UCLA for an undisclosed price. (Getty head Harold Williams is a regent of the University of California, and former UCLA chancellor Franklin P. Murphy is on the Getty board.) Before a designer was retained, the Getty announced a prestigious architect selection committee made up mainly of outside members. As it happened, however, the committee did not select an architect but only devised a short list, with Williams making the actual selection. And it is clear that the Getty is not happy about the nearby residents having a voice in the configuration of what is, after all, an incompatible use in their neighborhood.

At the zoning hearing, homeowners protested the uninformative nature of the presentation and won a delay of several weeks while the Getty prepared supplemental materials for their study. The irony of the situation is that such tactics raise suspicions where none should exist. Unlike the ersatz-Roman museum in Malibu, Meier's design seems a sophisticated response to very complicated requirements. It may not be the breakthrough in his work that some people were hoping for—if anything, it may turn out to be a reprise of some of his favorite building forms collaged together in a 1,400-foot-long cluster. But it is far less of an isolated object than has been true of his previous work, possessing a critical mass sufficient to create a good sense of place, and it shows a newfound concern with shaping exterior space. This latter quality will be strengthened by Wemple's appropriately polymorphous landscape design, which ranges from unobtrusive naturalism to geometric formalism and promises to make the Getty a true Los Angeles building despite its somewhat alien architecture.—JOHN PASTIER

News continued on page 20

Design from page 16

the proposed base is no more contextual than the Breuer original." Another former partner of Breuer, Herbert Beckhard, FAIA, pleaded with museum officials to abandon the current expansion plan. "The Whitney conceived by Breuer is a gravity-defying structure—a bird waiting to fly—while Graves's proposal is earthbound.

"The occasion for the presentation was an article from the Architectural Review: "Postmodernism is dead—it is no more than a painted corpse." He added, "Live by the style and die by the style."

John Johansen, FAIA, warned museum officials that they are investing $40 million in a style that is out of fashion and quoted a vocal critic of Graves's original and residents also spoke against the museum's expansion plan. "The property were left off, the buildings of neighboring Loyola Marymount University were represented in an unconvincingly crude way, and the circular tower of the nearby Holiday Inn was shown about 65 percent larger than actual size. And in its press release, the Getty gave the area of the center as 505,000 square feet, a narrowly defined net figure that was barely a third of the gross. All these details, of course, would tend to make the center itself seem smaller and less obtrusive than it actually will be.

It is difficult to understand why the institution felt it necessary to employ such tactics, for Meier's design, as far as can be determined from the presentation materials, is quite promising, and Emmet Wemple's landscape design is sympathetic and complementary to it. Perhaps there was a provision in J. Paul Getty's will that the Getty conduct its affairs with the same eccentricity and intrigue that marked his own life. Whatever the reason, the Getty by now has a long history of being less than sensitive to all its public obligations. When the original museum was built in Malibu, it was allowed to operate with inadequate parking because the city agreed to classify it as a single-family residence. Its director dismissed inquiries about its cost as irrelevant. (Even now, a project likely to cost between $200 million and $300 million is coyly referred to by museum officials as "$100 million plus."

The present mountainous site is isolated from the city fabric and not served by public transportation. It was acquired in an unannounced transaction from UCLA for an undisclosed price. (Getty head Harold Williams is a regent of the University of California, and former UCLA chancellor Franklin P. Murphy is on the Getty board.) Before a designer was retained, the Getty announced a prestigious architect selection committee made up mainly of outside members. As it happened, however, the committee did not select an architect but only devised a short list, with Williams making the actual selection. And it is clear that the Getty is not happy about the nearby residents having a voice in the configuration of what is, after all, an incompatible use in their neighborhood.

At the zoning hearing, homeowners protested the uninformative nature of the presentation and won a delay of several weeks while the Getty prepared supplemental materials for their study. The irony of the situation is that such tactics raise suspicions where none should exist. Unlike the ersatz-Roman museum in Malibu, Meier's design seems a sophisticated response to very complicated requirements. It may not be the breakthrough in his work that some people were hoping for—if anything, it may turn out to be a reprise of some of his favorite building forms collaged together in a 1,400-foot-long cluster. But it is far less of an isolated object than has been true of his previous work, possessing a critical mass sufficient to create a good sense of place, and it shows a newfound concern with shaping exterior space. This latter quality will be strengthened by Wemple's appropriately polymorphous landscape design, which ranges from unobtrusive naturalism to geometric formalism and promises to make the Getty a true Los Angeles building despite its somewhat alien architecture.—JOHN PASTIER
For beauty and long lasting protection, specify our unique Semi-Solid Stain.

"Cabot® premium quality Semi-Solid Stain is one of a kind. "With a single coat you get an opaque finish that highlights the natural texture of your wood. Plus deep penetrating wood preserving protection. In other words, Cabot Semi-Solid Stain combines the best features of a solid and a semi-transparent stain. "What’s more, Cabot Semi-Solid Stain provides beauty and protection that will last. It contains a mildewcide and wood preservative. It’s water repellent, and won’t crack, blister, or peel. In fact, we guarantee it for five years. "Of course, Cabot also offers you a complete line of stains, from Semi-Transparent, to Solid, to Decking products. All are of the finest quality and come with 110 years of experience in every can.

"Specify Cabot Semi-Solid Stain, available in 30 beautiful colors. It’s just common sense. Only Cabot can give you the ideal combination of beauty and protection that lasts. "We’d like to send you a free fan deck while supplies last, please circle reader response 35."

Common sense by the gallon

Circle 35 on information card
Cities
Boston Conference Explores San Francisco Downtown Plan

The San Francisco Downtown Plan came to Boston in April, along with several of its authors, apologists, critics, and sometimes-jealogueous overseers. The occasion was the symposium "Boston Looks at San Francisco," sponsored by the Boston Globe, the MIT school of architecture and planning, and the Boston Society of Architects. But the title could just as well have been "Boston Listens to San Francisco" because the West Coast delegation did most of the talking.

A development backwater for decades, Boston is now booming with millions of square feet of new office and retail space and millions more on the horizon. One waterfront proposal, the Fan Piers, alone will add 4.5 million square feet. A 1965 master plan, which sparked the redevelopment of downtown and the waterfront, is outdated; in preparing a new one, Boston, like many other cities, is looking to San Francisco for guidance.

From afar the San Francisco Downtown Plan looks like an enlightened expression of community will that strikes a balance between control and vision. In addition to reducing the height and bulk of new office buildings, it provides affordable housing, protects historic buildings, and requires that sun, shadow, wind, and other environmental matters be addressed in design. It is a bold and uncompromising attempt to reverse the conventional American pattern of accommodating growth first and worrying about the consequences later.

But nothing is ever what it seems. What started out as a high-minded consensus about the city's future, say San Franciscans, has deteriorated into a tense standoff between growth and no-growth factions, with the city planning department as intermediary. The need for a plan is not in question, only the wisdom of such provisions as the growth cap—an 11th-hour addition by the San Francisco Board of Supervisors that limits new office construction to 475,000 square feet per year. Developers must compete for this allotment in a so-called "beauty contest," with their projects reviewed by a team of advisors known as "the three wise men." No building was approved last year; round two is now under way, with a decision expected this summer.

Critics of the cap argue that by rationing office space the city has skewed the real estate market, driven up construction costs, and forced businesses to the suburbs. "The beauty contest is the worst part of the downtown plan," said Charles Graham of London & Edinburgh Trust, a competitor last year. "It pits one area against another. But it won't last long. Once we get politics out of the plan we can have something very positive for the future of San Francisco."

The cap's defenders reply that it was a rational response to the egregious overbuilding prior to the plan and to the continued grandfathering of large projects after it was adopted. They insist, however, that the cap is not antigrowth but merely a quantification of the real market's own projections about how much office space will be needed in the future.

"We were saying that the essential component of the downtown plan was the right of something else to survive besides vast office development," explained Sue Hester, a lawyer for San Franciscans for Reasonable Growth.

Nearly as controversial are the provisions for drastically reducing the bulk and height of new office buildings to make them more compatible with older buildings and with the surrounding landscape. Ornament and street activity are in, pompous plazas and mirror glass are out. Anyone familiar with the blank hunkering towers built in downtown San Francisco in the 1960s and early '70s will probably sympathize with this desire to make downtown buildings soft and decorative. But to others the new zoning envelope amounts to an arbitrary prescription for a postmodern skyline.

"You'd have to have one hell of a development package to get an International Style building approved in downtown San Francisco," observed Ed Logue, Hon. AIA, former director of the Boston Redevelopment Authority and the organizer of the conference.

But San Francisco planning director Dick Maier insists that style is incidental to safeguarding the civic purpose of architecture. "Our job is to represent the public in a process in which it has not been well represented. The idea that architecture has a privileged life, not to be tampered with by anyone, seems to us all wrong."

The reaction of Bostonians to this debate was understandably cautious. Boston is not as large or as wealthy a city as San Francisco, nor has overbuilding been an issue until recently. The idea of a growth cap, therefore, struck the natives against another. But it won't last long. "We have a nice balance here now," noted Tunney Lee, chairman of the planning department at MIT. "We have to be concerned with creating opportunities across the board so that there isn't a big gap economically between the highly paid office workers and the service people."

For better or worse, San Francisco has decided what kind of city it wants to be, while Boston is only beginning to ask the question. "We're where San Francisco was five years ago," said one panelist. The San Francisco plan spells out the rules of the real estate game for everyone, providing the clarity and predictability that developers say they want even more than favorable treatment. And it does so with rules, not mere guidelines.

Boston, on the other hand, has a long tradition of design review but no document that codifies its expectations. All downtown projects are reviewed by the Boston Redevelopment Authority, which approves or rejects them according to criteria that many developers complain are arbitrary at best and politically colored at worst. City officials have promised to correct this situation in their new plan, though they haven't yet explained how.

Like San Francisco, Boston clearly covets a sense of direction rather than the giddy feeling of being out of control. (Houston and Los Angeles may be the only cities that thrive on the latter.) But like most cities Boston also wonders whether it can legislate the kind of future it wants. San Francisco obviously thinks it can, and with its Downtown Plan may show the rest of the country how to make that viewpoint prevail. —DAVID DILLON

Architect Designs and Builds Prototype Homeless Shelters

They may not be the answer to sheltering the nation's homeless, but "city sleepers," designed and built by San Francisco architect Donald McDonald, FAIA, are now providing clean and dry refuge for a few of the architect's indigent neighbors.

McDonald recently completed a new building for his practice and noticed a number of homeless men sleeping in an adjacent parking lot. By talking with them, McDonald discovered that what they wanted most was a warm and safe place to sleep that would offer protection from harassment by gangs, police, and area homeowners. "Everything else they could take care of," McDonald says, stressing that his shelters are not intended as substitute housing for the unemployed or involuntarily homeless. City sleepers are for those who have opted to drop out of society and decline aid that would alter the life style they have chosen, McDonald explains.

What McDonald designed for them is continued on page 23
Above, located adjacent to McDonald’s office, the first two city sleepers and residents. Right, axonometric of the compact urban shelter for the homeless.

an oblong, plywood box four feet square in section and eight feet long, entered through a side hatch that swings up and can be propped open as a canopy. The architect says he wanted to make the shelters big enough for one person but small enough that they could be warmed with body heat. The interior has a four-inch foam mattress for sleeping comfort and insulation. There are two hinged vents and a sliding glass window with a screen. There is also a shelf and a locker. Each city sleeper rests on four inverted automobile jacks that can be adjusted for uneven terrain. Two prototypes, built for $800 apiece (out of McDonald’s pocket), are occupied next to his office.

McDonald says he would like to build 100 more city sleepers, placing them in groups of two and three on unused city and state property. “There are hundreds of acres of land under freeways in San Francisco,” he says, “and a lot of people are sleeping there now. The idea is to put the shelters where people are already—just exchange their place on the ground for a city sleeper.” McDonald has set up a non-profit corporation to solicit donations to build more shelters.

Meanwhile, the San Francisco city government has neither condoned nor hindered McDonald’s efforts. The California department of transportation informed the architect that if no city permits were issued for the city sleepers they would have to be removed, but no action has been taken. McDonald is now meeting with city officials to ensure that the shelters will remain.

McDonald says he would like to hear from other architects who have developed small-scale, inexpensive shelters for the homeless, so that ideas can be pooled and traded. His mailing address is: 165 Page St., San Francisco, Calif. 94102.

— Michael J. Crosbie

News continued on page 24
DEATHS

Richard D. Butterfield, FAIA, senior partner of Butterfield & Associates in West Hartford, Conn., and the Butterfield Partnership in Farmington, Conn., died in May at the age of 78. He designed more than 26 schools throughout New England. He also designed the master plan and numerous campus buildings for Quinnipiac College in Hamden, Conn. Butterfield received his bachelor's degree from Dartmouth College and his master's in architecture from Yale University. A member of AIA since 1949, he served as president of the Connecticut Society of Architects.

Robert O. Clements Sr., AIA, chairman of California's oldest architectural firm, Clements & Clements, died in May at the age of 69. Clements's firm has designed more than 110 buildings on Wilshire Boulevard, and he was responsible for two-thirds of them. He was a founder and a director of the Architectural Guild at USC, where he received his architecture degree.

Julian H. Harris, FAIA, was a sculptor and professor emeritus at Georgia Institute of Technology, where he had earned his bachelor's degree in architecture. He studied sculpture at the Pennsylvania Academy of Fine Arts in Philadelphia. His work was displayed at the High Museum of Art in Atlanta in 1933, 1940, and 1969, and pieces were shown at the Museum of Modern Art and Rockefeller Center in New York City. Harris was 80 when he died early this year.


Paul M. Heffernan, FAIA, joined the faculty of Georgia Institute of Technology in 1938 and directed its architecture school from 1956-79. Heffernan designed the Bush-Brown, Gailey, and Heffernan buildings on that campus between 1944 and 1954. He received the Eugene Dodd medal from Harvard University, the Paris Prize from the Society of Beaux-Arts Architects, and an AIA award for the Price Gilbert Library. Heffernan earned his bachelor's and master's degrees in architectural engineering from Iowa State University and a master's in architecture from Harvard University. He died in April at the age of 78.

Roslyn Lindheim, AIA, a professor of architecture at the University of California at Berkeley, developed a humanistic approach to hospital design, vividly portrayed in her design of the Planetree unit in Pacific Presbyterian Medical Center in San Francisco (see April '86, page 68). Throughout her career, Lindheim sought to counter what she called the "disturbing trends" in hospital design—an emphasis on technology and efficiency to the detriment of personalized patient care and a noninstitutional atmosphere.

Lindheim was an expert on health and environmental factors in hospital design. She was the first architect named to the Institute of Medicine of the National Academy of Sciences, in 1971. She is known for her leadership in renovating Montefiore Hospital in the Bronx, New York City, and for her work in hospital projects in San Francisco, Los Angeles, Iran, Israel, Sweden, England, and Canada.

A native of New York, she attended Radcliffe College and the school of architecture at Columbia University. In 1951 she joined the firm of Wurster, Bernardi & Emmons and later the firm of Stone, Marraccini & Patterson. Lindheim joined the Berkeley faculty in 1963. She died of cancer on May 5 at the age of 65.

Benjamin K. Ruehl, AIA, received his architectural degree from the University of Michigan in 1923 and then opened his own firm, Ben Ruehl Architects, in Spokane, Wash., where he practiced for 50 years. He died in May at the age of 87.

Martin C. Schwartz, AIA, a native of New York City and a Washington, D.C., architect since 1974, died on May 21. Since 1981, he had been affiliated with the firm of Clark, Tribble, Harris & Li, and in his early years with Howard, Needles, Tammen & Bergendoff. Schwartz received his architectural education at M.I.T.
BRIEFS

Architectural Reference Guide
The 1986 edition of *The Architectural Index* references *Architecture, Architectural Record, Builder, Interior Design, Interiors, Landscape Architecture, Progressive Architecture, The Journal of Architectural Education* and the last issues of *Architectural Technology* and *Solar Age*, as well as *Professional Builder*, the successor to *Solar Age*. Articles are listed under project type, architect or designer, and location. Copies are available for $18 from The Architectural Index, P.O. Box 1168, Boulder, Colo. 80306.

Student Design Competition Winners
Marta Canaves, Marta Nejia, and Herman Lopez of Florida International University won $5,000 and first place in a design competition sponsored by the American Institute of Architecture Students and the American Life and Accident Insurance Co. of Kentucky. Second place prize of $3,000 went to David G. Arkin, University of Minnesota; and third place prize of $1,000 went to Carlene Nolan-Pederson, Montana State University.

Product Design Awards Competition
The Resources Council has set Sept. 18 as the deadline for an interior furnishings product competition. Products must have been made available for sale between June 1, 1986, and July 31, 1987, to be eligible for entry. The entry fee is $100 for members and $175 for other firms. For more information, contact the Resources Council, 200 Lexington Ave., Suite 227, New York, N.Y. 10016.

Concrete Design Awards
Prestressed Concrete Institute is sponsoring a design competition open to all architects and engineers in the U.S. and Canada who have designed buildings using precast or prestressed concrete. The deadline for submittals is July 31. For more information, contact Dawn J. Myers, PCI, 175 W. Jackson Blvd., Chicago, Ill. 60604.

Veterinary Hospital Design Winner
A joint design by Sharon Moroz, a student at the school of veterinary medicine, Louisiana State University at Baton Rouge, and Rodolfo Barrio, an architecture student at LSU's school of architecture, won first place in a student design competition for a veterinary hospital sponsored by Hill's Pet Products.

Brunner Prize Winner
James Ingo Freed, FAIA, a partner of the firm I.M. Pei & Partners, New York City, was awarded the 1987 Arnold W. Brunner memorial prize in architecture from the American Academy and Institute of Arts and Letters.

When it matters . . . Be OnTarget.

OnTarget is a powerful new project management program. Easy to learn, simple to use. OnTarget is like having a project management team on duty 24 hours a day. Planning, Monitoring, Project overview. OnTarget tells you what you really want to know. When you want to know it.

In seconds, you know where you are. Where you should be. And what impact those inevitable last minute changes will have on your project. OnTarget encourages you to be creative. To play out those “What if’s?”

Printer ready graphics, records and reports. Even automatically synthesized fee structures. OnTarget is a complete project management program. You simply fill in the blanks with your best guestimates. OnTarget does the rest.

Whether your project is large or small, the benefits are big when you are OnTarget. Clients are happier. Decisions are made on time, on budget and OnTarget. And you can transfer information from OnTarget to other programs. Your productivity goes up. And so do your profits.

OnTarget. Powerful. Easy to use. Call today. We'll put you OnTarget.
For renovating, retrofitting or remodeling, we complete the picture.

Picture Curries right here.

For all the hollow metal doors and frames you need. To fit masonry, dry wall or poured concrete of any thickness. Exactly.

Curries' frame line offers you a wider range of sizes, jamb depths, face widths and profiles to choose from. No one offers you more.

Your Curries Distributor has in inventory replacement doors that can be modified to fit any existing frame.

All Curries doors and frames are built one way. Solid. Frame components are one-piece construction. Not two or more. And no matter how many different sizes, gauges, types, grades, colors and configurations you call for, you get them. Period.

You get them on time, too. Correct. Complete. No excuses. No matter if your order is pre-engineered or custom. Or both.

So call your Curries distributor today. He's got inventory, ready to go. And he can customize your order locally. Plus, he can take care of all of your finish hardware requirements. He's in the Yellow Pages under "DOORS" or "DOORS-Metal" Or see Sweet's 8.2 Cur. Curries Company, 905 South Carolina, Mason City, IA 50401.

© Curries Company 1987 CD-1887

CURRIES
A Unit of L. B. Foster Company
FOSTER
This issue is unified by a focus on residential work, but it is otherwise quite varied. It includes a poignant news report on one architect’s very personal approach to the problem of the homeless. It also includes a collection of architect-designed birdhouses that one is sorely tempted to call flighty.

It presents, on immediately following pages, a set of varied and mainly elegant houses. They are followed in turn by a sobering discussion of the faltering national effort to house the poor. The basic conclusion is that, not only are we not adding to the supply of low-income housing built up over the last half-century, but a variety of factors are producing a net reduction in that supply—even as demand, and poverty itself, increase.

A more encouraging effort is reported in this month’s Technology & Practice section as part of a package on seismic design. It is the amazingly swift and sensitive reconstruction of entire neighborhoods all but destroyed in Mexico City’s 1985 earthquake.—D.C.
Five Volumes Strung Along a Hillside

House in Tesuque, N.M., Antoine Predock, FAIA. By Allen Freeman
There's less here than meets the eye; only about 2,300 square feet of house. Architect-illusionist Antoine Predock, FAIA, pulled apart five main volumes—living room, master bedroom stacked over dining room, kitchen, second bedroom, and garage—staggering, elevating, and twisting each so that none aligns with another in section or plan. He painted each piece a different color, the lower ones light earth tones, the upper ones icy tones of lavender and silver-gray, and set the ensemble into the hillside near its crest, so that a line of trees halos the roofs.

Then he shrunk the pieces and left no clues. The front door might have given the scale away, but he sucked it in, between the turret and the blocky piece of the second bedroom, making it read as a void. Similarly, he recessed the balcony door at the end of the large basilican form, segmented it vertically, and partially concealed it behind the parapet. And he scaled down the windows, punched them in, and positioned them to imply greater internal division than exists.

Located in the piñon- and juniper-covered hills of northern New Mexico in the rural settlement of Tesuque (pronounced see-sue-que) just north of Santa Fe, the pieces bear resemblance to nearby vernacular houses and the ensemble to villages in the hills of northern Spain, where Predock spent time as a student. But the whole is slightly abstracted, like a stage set.

The house also reflects the theatrical bent of Predock’s clients, one of whom performs semiprofessionally as a soprano in operettas and musical comedies. Her husband is an amateur musician (and professional attorney). Their living room is a musical stage that fills the silvery, gable-roofed piece at the south end. Resembling a miniature recital hall made bright with daylight entering all four sides, this double-height, 18x30-foot room is ideal for intimate musical performances. At the rear, a balcony/study projects above the connection to the rest of the house; the “stage” wall opposite consists of a fireplace and three large windows, two of which flank the chimney and frame views into the hills. The third window is directly over the fireplace, and through it you see the chimney stepping up and away from the house. At certain times of the day, depending on the season, the sun hits this inward-facing stucco wall and turns it into a lovely indirect source of daylight. The steps add a little mystery.

If the living room resembles a basilica, the master bedroom recalls a castle keep. The central elevated room, it is reached by tightly wound stairs in the turret. From the bedroom’s windows and balcony, the architect framed views of the Jemez Mountains, lights of Los Alamos, and fragments of the house itself.

Adroit, picturesque, theatrical—the house in its setting is smaller than perceived yet larger than life.
Above, the living room with light entering from four sides. Right, greenhouse hall leading to that room. Plans show yet unbuilt third bedroom and living room alcove.

1. Living room
2. Alcove (unbuilt)
3. Library/bar
4. Greenhouse
5. Second bedroom
6. Laundry
7. Third bedroom (unbuilt)
8. Dining room
9. Kitchen
10. Garage
11. Master bedroom
12. Study

Second floor

First floor
Highly Sophisticated ‘Cabin in the Woods’

House in Door County, Wis., Hammond Beeby & Babka. By Lynn Nesmith

This year-round vacation house by the Chicago firm Hammond Beeby & Babka captures both the airy spirit of a summer house on the lake and the cozy feel of a cabin in the woods. Moreover, the front and back elevations of the house reflect its dual personality.

The context is Wisconsin’s Door County, a long and narrow peninsula with a rocky shoreline interspersed with sandy beaches. The wooded landscape, dotted with farms, cherry orchards, and romantic waterfront communities settled by Scandinavians more than a century ago, is a haven for Midwesterners who for years have flocked to the shores of Lake Michigan in summer and now in increasing numbers visit the region in winter for cross-country skiing and other cold-weather sports.

The approach to the house and its generous nine-acre site is by a curvy, unpaved road through a heavily wooded area sparsely populated with other vacation houses. The first view of the house is a trio of gables reaching for the sky and an irregular grouping of a bay window and three smaller openings, which define the service areas and the children’s bedrooms.

John Syvertsen, AIA, principal in charge (although no longer with the firm), borrowed freely from the details and forms of the local farm vernacular and clad the 2,700-square-foot house with cedar siding left to weather and with bright barn-red vertical battens. The red is repeated on exterior window and door trim and under the eaves of the gabled roofs.

These informal, shed-like volumes set slightly off balance don’t prepare one for the broad and open symmetry of the waterfront elevation, but the two are decidedly complementary.

Facing the lake, a central, sweeping stairway leads to an open deck and the central focus of the house, a grand living space reminiscent of old summer camp porches. Set atop the house is a covered sleeping/observation porch off the master bedroom.

The great room, which measures almost 40 feet from end to end, is wrapped with continuous double-hung windows providing three exposures. The unusual site orientation, with the shoreline facing almost due north, forced the architect to slightly tilt the house to maximize views to the lake while maintaining southern exposure for the room.

Inside, the sloping ceiling with pine trusses, vertical board wainscoting, and pine flooring all respond to the rustic and rural context without literally quoting a style of the past. The dining and sitting areas in the great room encourage a variety of activities simultaneously. The second-floor children’s bedrooms, with apple-green walls, project into the space to create a cozy nook facing a friendly fireplace. The oversized diamond windows open to provide the children with their own observation points.

With its shed-like volumes, varied roof forms, and indigenous materials, this house resembles the nearby farm complexes, which have evolved over time. Yet what at first seems a chaotic organization ends up a total composition.

Above, the site’s natural rock outcroppings and the balanced lakefront elevation. Above right, asymmetrical entry facade; right, side elevation reveals the happy coexistence.
Right, the parents’ private retreat, the third-floor master bedroom and porch, has sweeping views through the treetops to the lake. Opposite page, above, interior detailing is meticulous throughout, including chamfered pine door and window trim, painted wainscoting, and the smiling hearth; below, glass doors and bands of windows flood the great room with natural light while creating the spirit of an old-fashioned screened porch.
'Miniaturized, Fairy-Tale Castle'

*House on the Severn River, Md., Bohlin Powell Larkin Cywinski.*

*By Andrea Oppenheimer Dean*
The brothers Grimm seem to co-exist here with old Maryland families and latter-day Gatsbys. The southern part of the site—a mostly deciduous forest, hushed and bathed in filtered light—could be the setting for a fairy tale. At its northern edge, the site forms a high bluff that drops to the Severn River, whose sloping shores are dotted with the private docks of colonnaded houses, some recalling antebellum plantations.

In spirit, this house north of Annapolis, Md., is kin to another that the architecture firm Bohlin Powell Larkin Cywinski completed in 1981 for Norman Gaffney (see Mid-May '81, page 175). It was a deceptively simple yet sophisticated rendition of a house as seen through a child’s eyes or altered by childhood memories—full of soft edges, skewed axes, scale distortions, and allusions to times past. The clients for the Annapolis house, in fact, chose BPLC as architect because the Gaffney house seemed to “have qualities of an old house though it was new, looked uncomplicated and clean, yet childlike.”

The entry elevation resembles a miniaturized, fairy-tale castle or an exaggeratedly tall, elaborate cottage composed of angled elements—a little, red-roofed, gabled entry mass attached at a diagonal to a very tall house form from which yet another appendage twists off to the west. The main purpose of these axial nudges is programmatic—to give a variety of diagonal views of the site and river.

A taut skin of vertical redwood boards resembling stucco prevents a too cute look, while accordion-like glazing on one side of the little entry house and green lattice on the adjoining tall mass are reminders that this charmed fantasy in the woods is also of its own time. The lattice, which steps out as it approaches the base, helps ground the elongated wall supporting it and in time will be overgrown. But mainly, it perks up an otherwise slightly awkward wall, and, like one or two similar devices on the interior, ends in calling attention to a minor flaw.

While the entry elevation is diminutive in scale, the north facade, overlooking the water, is grand and formal in a quirky way. It is marked by a high, glazed porch tucked at a cant (to gentle its corners) under the eaves of a steep roof, which is stiffened by a sturdy green truss and supported by an oversized yellow column. Peter Bohlin, FAIA, explains that, like other houses on the Severn, this one wanted to make its presence felt from the water. Unlike (but still reminiscent of) nearby traditional houses that face the river with long, colonnaded verandas, this one uses a tall, narrow porch and a single column to call attention to itself. At night the glass porch resembles a huge lighted beacon.

Like the exterior, the interior combines coziness with contemporaneity. At the entry a stair with cottage detailing and a little square window rises with a pause at the second-story landing—where there is another single yellow column—and climbs to the third-floor eaves, revealing perhaps a surfeit of variously angled shapes. To the left of the entry, down half a flight, under the exposed ceiling beams of the north-facing living room, a win
dow frames a sliver of the adjoining glazed porch and the water beyond. There are plenty of perspectives and movement, and the spaces, as in a modernist plan, are open, though delineated by gray-painted boards that contrast with the yellowish pine flooring. But as in a traditional plan, the living areas are centered on and anchored by a fireplace, whose chimney rises on one side of the stair to make its presence felt upstairs as well as down.

The second and third floors have two rooms apiece, and, as at the Gaffney house, interior windows bring in light and give a feeling of connectedness between rooms. In the second-floor study, for instance, a large stepped opening overlooks the stair and chimney, while a smaller one links with the living room. Across from the study is the master bedroom, where a lowered ceiling with exposed beams shelters the bed. Adjoining it are remarkable washrooms: twin showers, each with a window overlooking the river; two sinks separated by a window; and a paneled water closet.

Summarizing the virtues of this deceptively modest house is the third-floor guest room. It is a simple space in shades of gray with yellow and green accents. Treetop views in three directions appear through cozily low, square windows over whose painted frames is suspended a loft. Leading up to the loft is a wooden ladder with a vaguely nautical, gracefully curved yellow metal rail, which at its top gives way to a handsome wooden balustrade with a yellow accent. The space feels like country without fuss or sacrifice of sophistication, a result largely of its ample but modest scale, deft proportions, and artful detailing.
Elaboration of Regional Building and Crafts

House near Houston, Clovis Heimsath Architects.
By Allen Freeman

Deep in the hearts of many Texans, local lore and culture rank close to free enterprise, as illustrated by this private retreat celebrating regional architecture and crafts. It is engaging if overloaded.

Designed by Clovis Heimsath Architects of Austin for a prominent Texas couple, Fire Meadow, as it is called, is located 50 miles north of Houston, where the exurbs thin out and pine forests still grow thick, on a 5,000-acre ranch with exotic species of deer, coveys of wild turkeys, and quarter horses. The owners asked Clovis Heimsath, FAIA, first to restore a 100-year-old farmhouse and then to build this retreat on another part of the acreage, just inside the tree line on a gentle slope above pastureland and a man-made lake. They wanted accommodations on the ranch for annual extended-family reunions at Thanksgiving and for occasional church gatherings.

Fire Meadow's precedent is the Western dude ranch, where separate sleeping cabins attend a lodge for chowing down and socializing. Heimsath laid out the lodge and the four cabins on

Above, left, and axonometric, the front elevations zigzag among the trees. Right, the back side with corner limestone chimney.
a superimposed double grid, with one axis rotated 45 degrees. The rotation is expressed in the lodge's square, second-story form that rises from a larger, square, one-story base, and in the diagonally oriented, sawtoothed front of the companion building comprising four sleeping suites laid out side by side.

Each suite opens onto an open porch whose standing seam metal roof zigzags in front and then crosses 25 feet as a breeze-way to the lodge, where it skirts one of the four elevations. An awkward transition occurs where the porch ends abruptly at the corner of the house, as if the next elevation faced the side yard. Especially with the lodge rotated 45 degrees, this "side" elevation is prominent from the front, where the porch profile seems out of place and unresolved.

Cladding for both buildings is cream-colored clapboard with brown painted framing, scalloped shingles, brown decorative tile, white stucco, and limestone. Accenting all this are bargeboards, comb ridges, and chamfered porch columns, all found on Texas farmhouses. The limestone base is typically Texan, but Heimsath stairsteps it up one corner to meet a chimney in an untraditional way, forming the two handsomest elevations on the dwelling.

Seeking to individualize the four suites, the owner named them for nearby communities and Heimsath then tailored an identity for each based on strands of Texas's past: Hispanic, Southern colonial, arts and crafts, and early settler. Each suite has a different plan, all have bathrooms shoehorned into odd, interesting spaces along the rear elevation, three have lofts, and the fourth a rooftop screened porch. Heimsath's partner and wife, Maryann, designed five-part stained glass windows for three of the suites and the lodge, and coordinated all of the handcrafted work.

As with the suites, the ground floor of the lodge is appropriately open and homey. It focuses on a freestanding limestone fireplace whose chimney rises into a corner of the rotated second story, where there is a small bedroom loft.

Fire Meadow's architectural interest lies neither in purity of concept nor in pristine execution, for it veers close to pop kitsch ("Four Flags Over South Texas") and the finishes that are not handcrafted are routine. But it is a spirited synthesis.
Architectural Jazz and Solar Ingenuity
House in a Washington, D.C., suburb, Jersey Devil. By Michael J. Croslie

It's called the hoagie house—a private residence of heroic proportion, commanding the highest hilltop in a suburban Washington, D.C., county. This house defies easy categorization. It is a mysterious, inscrutable invention of no discernible "style," at a time when knowing the rules of style and how to break them distinguishes an accomplished architect. This architecture is not about architecture. It's a three-dimensional Rorschach test. What do you see? Boats? Spaceships? Bridges? Submarines? They're all methods of conveyance, and the hoagie house has the power to transport us outside the realm of architectural convention.

It was designed and built by Jersey Devil, a quartet of itinerant architects whose members include Steve Badanes, John Ringel, Jim Adamson, and Greg Torchio. For the past 15 years the devils have raised houses with such monikers as snail, helmet, silo, airplane, and football, so the hoagie appears in good company. At 10,000 square feet, comprising a main house, a gate house, and a guest house, the hoagie is their largest creation to date, taking three years to complete.

In the past the devils have made the sketchiest of plans or a quick study model, camped out on the building site, and figured out the details as they went along, keeping the design open enough for on-the-spot improvisation—a sort of architectural jazz. Because of its size and complexity, the hoagie house demanded lots of drawings and myriad subcontractors for such things as the reinforced concrete slab and the steel structure. But the devils were there every day, orchestrating the trades and the dozens of artisans they invited to lavish this house with handcraft.

The client—a high school classmate of Badanes's—hired a private detective to find the architect, who lives wherever he happens to be building. There was nothing out of the ordinary in the program to serve the client, his wife, and their four daughters, except that it be a large house and informal. The devils were given full rein and a seven-figure budget, allowing them to be as creative as they wished.

The six-acre site is wooded and hilly, its summit edged by a rock outcropping running north-south and skirted by blossoming mountain laurel. As the program requirements filled the plan, tight site restrictions pushed the hoagie out over the cliff, prompting the devils to create a spectacular cantilever that appears to hover above its corbeled pedestal. To ascend the summit, one follows a winding drive that passes below the cantilever and heightens the hoagie's mystery.

The main house is connected to its sibling buildings—the gate house and the guest house—via tubular bridges that follow the outcropping. These smaller buildings were used as dress rehearsals for the main house, places to experiment with materials and test a prototype of an experimental skylight device called the Roto-Lid. The gate house (a caretaker's residence) is a cozy apartment cantilevered over a one-car garage, while the guest house is an outlandish fusion of curves and decks—one apartment above another, accessible by a wiggle of stairs.

These two buildings employ just about every imaginable curve and were ideal for exploring different cladding techniques. The roofs, like those in the main house, are terne-coated stainless steel that will mellow into a dusty gray. The natural cedar siding is conventional clapboard used in an unusual way. Because clapboards taper in section, they bow like a frown when applied to a convex surface. Each curved clapboard had to be cut like a smile so it would appear dead level when installed. It would have been easier to use vertical siding, but that would have ruined the hoagie's streamlined sweep.

To keep the house's interior flexible enough for impromptu design, the structure is a steel frame with a cantilevered roof.

Across page, hoagie house's central skylit corridor in view looking west toward master bedroom suite, with Roto-Lid positioned to admit direct sunlight. At right in photo is a curved glass office. Above left, detail of southeast corner.
This allowed all the walls to be structurally independent of the roof. It was also a quick way to get the building enclosed before the weather turned cold, so that the devils could work unencumbered inside. Decisions about details and finishes were often made as building progressed, sometimes resolved with a hasty sketch on a scrap of 2x4.

The size of the hoagie house (Badanes likens it to a mini shopping mall) also allowed plenty of room for many talents. The house became an armature, and the devils, acting like medieval master masons, coordinated a small army of artisans and craftspeople that transformed architectural elements such as cabinets, stairs, and doors into works of art.

The organizing element of the house is the Roto-Lid, a computer-operated shading skylight invented by Adamson, which automatically moves with the time of day and the seasons. (Its operation is described in detail on the facing page). Like the Roto-Lid, the house is linear and has long north and south exposures. Inside, the Roto-Lid enlivens the house with generous sunlight, purging dark corners and making the interior of this big house appear even larger than it actually is. As counterpoint, nearly all of the artificial lighting is indirect, either neon or up-lights that wash curved surfaces and accentuate their geometry.

The Roto-Lid “can be left alone for years and the owners don’t have to do a thing,” says Adamson. It is only one of the house’s technical marvels, however. A low-voltage artificial lighting system is programmable so that every fixture in the house can be turned off, on, or dimmed from a single point. The house has an automatic watering system for the interior’s numerous planters, a central vacuuming system, stereo speakers everywhere, and motorized window shades. Operation of these gadgets and maintenance of the house is covered in a 150-page owner’s manual written by the architects.

The daylighting theme of the Roto-Lid is introduced at the front door, on the north side. One arrives at the naturally formed white oak “tree door” (by Tom Galbraith) via a bridge from the gate house motor court. The two-story foyer is a well of sunlight, purging dark corners and making the interior of this big house appear even larger than it actually is. As counterpoint, nearly all of the artificial lighting is indirect, either neon or up-lights that wash curved surfaces and accentuate their geometry.

The daylighting theme of the Roto-Lid is introduced at the front door, on the north side. One arrives at the naturally formed white oak “tree door” (by Tom Galbraith) via a bridge from the gate house motor court. The two-story foyer is a well of sunlight, purging dark corners and making the interior of this big house appear even larger than it actually is. As counterpoint, nearly all of the artificial lighting is indirect, either neon or up-lights that wash curved surfaces and accentuate their geometry.

The organizing element of the house is the Roto-Lid, a computer-operated shading skylight invented by Adamson, which automatically moves with the time of day and the seasons. (Its operation is described in detail on the facing page). Like the Roto-Lid, the house is linear and has long north and south exposures. Inside, the Roto-Lid enlivens the house with generous sunlight, purging dark corners and making the interior of this big house appear even larger than it actually is. As counterpoint, nearly all of the artificial lighting is indirect, either neon or up-lights that wash curved surfaces and accentuate their geometry.

The organizing element of the house is the Roto-Lid, a computer-operated shading skylight invented by Adamson, which automatically moves with the time of day and the seasons. (Its operation is described in detail on the facing page). Like the Roto-Lid, the house is linear and has long north and south exposures. Inside, the Roto-Lid enlivens the house with generous sunlight, purging dark corners and making the interior of this big house appear even larger than it actually is. As counterpoint, nearly all of the artificial lighting is indirect, either neon or up-lights that wash curved surfaces and accentuate their geometry.
The hoagie's Roto-Lid—a skylight with rotating insulation—is the invention of Jersey Devil architect Jim Adamson. “With open skylights you get plenty of sunlight,” explains Adamson, “but during the summer the space can overheat, and in winter you lose heat at night.” The Roto-Lid is based on an equilateral triangle with a rotating panel of insulation that has three positions. Always on an east-west axis, during a winter day the panel faces north, admitting the sun’s warmth. On a winter night the panel rotates to seal the triangular chamber from the interior, preventing heat loss. On a summer day the panel faces south, admitting northern light and minimizing heat gain.

Adamson built a Roto-Lid prototype with the help of a U.S. Energy Department Grant. The prototype was installed on the hoagie’s gate house and tested, prompting modifications for the seven Roto-Lids that crown the hoagie house. The panels’ seals were tightened with Teflon-coated cloth, and the triangular chamber was changed to a vault of double-layered clear plexiglass in keeping with the hoagie’s theme of circles and curves. The anodized aluminum panels, which have three-inch insulation, are counter-weighted and in perfect balance so that very little power is needed to rotate them. Each Roto-Lid turns on a 1/80th horsepower gear motor.

Adamson says that the hoagie house Roto-Lids are a lot “smarter” than the prototype: a computer controls their position (the prototype operated on a light sensor). As the summer sun slowly crosses the sky, the Roto-Lids move with it, controlled by a program that accounts for solar angles, the latitude, and the date. —Michael J. Crosbie
of rooms shares a bathroom. The hallway in the east wing is paved with glass block, allowing natural light to the first-floor corridor.

Way up at the west end, behind the fireplace wall, is the master suite—the most sumptuous of the house's spaces, with a party-sized bathroom and a series of closets and dressing rooms lined with mahogany and birch cabinets. You have to walk through the bathroom or the dressing rooms to get to the bedroom, which is actually quite small in contrast and is occupied by two steel I-columns sheathed in cedar. The bedroom doesn't have a skylight (a dressing room does), which would have made it a far more exciting space than the room where you pick out your earrings. There are built-in cabinets below the west windows, in front of which pops another television set. This isn't a room for reveling in sunsets, and it points up a quirk about this house: beautifully sited and environmentally designed, it has little dialogue with nature. Many of the spaces, such as the conversation pit, the media room, and the master bedroom suite, are inwardly focused. Although bridges lead to and from the house, there are few architectural gestures toward the site. Windows admit light, but don't necessarily frame views. Like a spaceship or a boat, the hoagie house is self-contained. This is entirely appropriate for clients who covet their privacy, and with all that luscious woodwork and handcraft there's plenty to focus on inside. But a melding of inside and outside seems a missed opportunity.

That deficiency aside, the hoagie house, with its gate house and guest house in supporting roles, is an edifying architectural anomaly in an age of deteriorating craftsmanship and environmental indifference—an affirmation of the architect and builder's magical mixture.
Right, view of conversation-pit corner, with bar and spiral stair in background, all under a canopy of natural light. Left top, inwardly focused media room is found on opposite side of fireplace; left middle, detail of spiral stair; left bottom, car fireplace's internal combustion.
Ma is a term much used by interpreters of Japanese culture. It might be translated as “meaningful interval” and can refer to the pause between movement in a No play or the space between stones in a Zen garden. Behind it is the notion that inaction or emptiness is as significant as action or plenitude. However, though emptiness may be appreciated in traditional architecture, it is not a notable quality of the typical Japanese house of today. Consumers are forced by the exorbitant cost of land into living in tiny houses, which are, perhaps in compensation, not only crammed with household goods on the inside but often ornamented with a multitude of excrescences on the outside.

The Home Show, a collection of houses by various manufacturers, is open to the public and is located in Futako Tamagawa in Tokyo. The houses are a motley lot, built in widely differing styles derived for the most part from Western architectural sources. In their midst is a building exhibiting a bold use of forms that manages, without being obvious, to evoke the spirit of traditional Japanese architecture—and the spirit of ma. Maison 2001, as it is called, serves as a reception center, showroom, and gallery for the ABC Development Corp. Maison 2001 was designed by Steven D. Ehrlich, AIA, of Venice, Calif.

Tomomasa Hayashida, an executive of ABC, which manages the Home Show, wanted something more than the makeshift shelter normally used to receive visitors to such a show park in Japan—he wanted a building that made a “statement.” He turned to Ehrlich, whom he had met at a home builders’ convention in Dallas.

Ehrlich calls this “an unusual hybrid,” “a global, binational project,” and cites it as “proof that the world is becoming a global community.” This seems a trifle premature, given the modest scale of the venture, but the building undeniably did its bit to foster international cooperation. However, Maison 2001 also appears to underline certain cultural differences. The majority of Japanese architects remain engineering-oriented, and Ehrlich’s approach, which evidently stresses the development of purely architectonic ideas before any consideration of materials or structure, proved a novelty for the Japanese involved in the project.

Atsushi Yamada of Tokyo, the associate architect, recalls how subcontractors tried their best to persuade the architect to
Above, looking through the central galleria to the termination of the 'sacred pathway,' right. Opposite page, exhibition wing.

construct the building their way (the conventional way), but to no avail. "Perhaps as a result the building is not entirely rational," says Yamada. For example, "the roof truss is complicated, with members coming together at odd angles." Yet Yamada thinks that working with the American architect was a broadening experience for the Japanese concerned, in that it opened their eyes to an approach that was not strictly empirical.

The building, with its Y-shaped plan, sits on a corner site. Reflective panels, set in a three-foot grid of Cor-Ten steel, mirror nearby cherry trees and manufacturers' houses and are intended to be an interpretation of shoji screens. The roof is also of Cor-Ten steel, and the way the entrance canopy juts out vaguely suggests a feature of the Japanese folkhouse.

Running down the middle of the building is a galleria, a series of spaces defined by precast concrete panels and lintels, which were inspired by torii, the gates of Shinto shrines. From this two wings branch off, one used as an exhibition area and the other as a showroom. Movement through the galleria is clearly meant to take on a processional quality, as indicated by Ehrlich's statement concerning a "sacred pathway," but the fact that one enters the first space from the side and that there are only three spaces in the series weakens this effect. The scheme is more in the nature of a centralized plan, focused on the second space, which is lit by a high window. Ultimately, instead of a sense of movement, the plan and the proportions of the building instill a sense of repose. This works to the structure's advantage, however, for its feeling of stillness provides a sharp contrast to the continual movement of the builders' houses, with their twisting, narrow corridors and highly compartmentalized spaces.

Maison 2001, despite its name, is not a patently futuristic work. Indeed, it is only a series of spaces with barely a functional rationale. Ehrlich even banished the real, as opposed to the showroom, toilets to a separate building. (It would have been a further improvement had he banished the showroom, which was the responsibility of an interior designer and is a disappointment.) By stripping the building down to its essentials—that is, by providing a strong roof form supported by monumental columns and by dematerializing the walls—the architect reminds potential buyers who traipse through the Home Show how the Japanese for ages have created places. Rest and emptiness, the building hints, are as important as frenetic movement and plenitude. Less is ma. ☐
Woodstock, N.Y. The name recalls the 1969 three-day rock festival, though that was disowned by Woodstock's conservative city fathers and actually took place 60 miles away on a farm near Bethel. The real Woodstock is a little town in the Catskills, full of crafts and antiques shops, with an arts tradition dating from the 19th century, when artists, loosely united as the romantic Hudson River School, came to paint and subsequently attracted tourists. Woodstock is also the site of Robert Kliment's and Frances Halsband's weekend and summer home and what they call their "country doctor" architectural practice. Its most recent product is a tiny, amiable gate house, a combination garage and apartment for a Woodstock estate.

At least three qualities come together to transform what might have been just a friendly little folly into interesting architecture. The first is its siting as a transition between the valley it overlooks and the wooded mountain into which it backs. In fact, its first-floor cladding of bluestone from local quarries is an extension of the retaining wall separating the hill from the clearing at its base. Kliment aptly calls the dwelling a "wall house."

Then there is the matter of the peculiar axis. To transmute the building into a gate house, the architects pulled the east-facing porch away from the rectangle of the house at a 19-degree angle to parallel the alignment of the nearby main house and topped the porch's wide, south-facing corner with a tower. It is the main focus of the little house and a new pivot point for the property.

Finally, the architects achieved a crafted, but not saccharine, demeanor through controlled rusticity—cedar shake cladding with simple and rudimentary but appropriate trim and detailing. To give the illusion of the east facade as a sort of face peering at the clearing, says Kliment, the gables—which overarch the two east-facing windows like eyebrows—were fitted into the plane of the wall, rather than pushed over the eaves.

The interior is just two rooms—a living and dining space focused on the porch and a purposefully pint-sized penumbral bedroom facing the back wall, which also contains kitchen and laundry spaces. The living area's most striking feature is its peaked ceiling. Above exposed trusses, it is papered in a green and tan floral pattern to suggest a leafy cover. It is a fittingly romantic touch for a romantic little gate house.
Left, angled porch made way for corner tower, which creates gatehouse effect and, as seen at right, top, aligns building with axis of main house. Interior (right, center and bottom) is a single space (plus unseen bedroom) topped by papered ceiling resembling foliage.
Housing for the Poor:
Losing More Than We Build

So far no real substitute has been found for a positive federal role.
By Nora Richter Greer
As 1990 approaches, so does a housing crisis of a magnitude not seen in the United States since Franklin D. Roosevelt called a third of the nation "ill housed" as he launched his New Deal. If current trends persist, by the turn of the century nearly the same percentage of the population could be living in substandard dwellings, be paying excessive rents, or be homeless altogether.

The causes of the crisis are interrelated and complex, centering around the virtual dismantling of federal low-income housing programs. The solution will necessitate a new, long-term financial commitment by the federal government, housing experts say. But just as assuredly, what is being called "the vigorous new creative thrust" of cities and states toward housing their poor will significantly transform national housing policy.

What has housing experts concerned is the impending influence of trends in federal housing: the virtual halt of low-income housing construction; the aging and decay of subsidized housing projects, accelerated by dwindling rehabilitation funds; and the expiration of 20-year contracts with private sponsors of low-income housing. HUD's budget has dropped from $35.7 billion in fiscal year 1980 to $14.2 billion in fiscal year 1987. Although an exact tabulation is difficult to make, it is quite clear that many more low-income units are lost each year than replaced. Roberta Youmans, of the National Housing Law Project, predicts that in about five years a "massive influx of money will be necessary" to remedy the situation.

With the drop in production of new units and the rise in the number of poor, there are long waiting lists for public housing. Among the worst cases, according to the Council of Large Public Housing Agencies, are Baltimore, with 13,000 families waiting for openings in 17,000 existing, occupied units, and Chicago, with 44,000 families waiting for openings in 49,000 units. In fiscal year 1987, 74,000 new units were built, down from 192,000 in 1980 and from 393,000 units in 1977. The units being built now were authorized during the Carter years; under the Reagan Administration, new construction contracts have virtually stopped. Just as damaging has been the meager provision for rehabilitating public housing units, half of which are over 20 years old. Since 1975 the government has spent $7.9 billion for repair and modernization; for fiscal year 1988, the Administration has requested $437 million. At the same time, ABT Associates, a private research group in Cambridge, Mass., has reported to Congress that $21.5 billion is needed to repair and modernize the nation's 1.3 million units of public housing. Each year, as many as 70,000 units of public housing are abandoned or demolished because repairs are too expensive. For example, in 1986 the Philadelphia Housing Authority closed two 15-year-old towers because the $18 million cost to repair them was prohibitive.

The biggest crunch, though, is expected in the coming decade, when contracts the federal government made with private owners of subsidized low-income housing start to expire. The owners will have no obligation to either the federal government or their tenants and will be able to convert their units into higher-rent condominiums, sell their buildings, or even tear them down. The General Accounting Office predicts a reduction of as much as 900,000 units by 1995. Others are less pessimistic.

William Apgar, associate director of the MIT/Harvard Joint Center for Housing Studies, warns, "We could be entering a period in which additions to the subsidized inventory are needed just to keep the number stable." The National Association of Home Builders estimates it would cost more than $130 billion to replace the current supply of subsidized housing.

The Reagan Administration's sole housing initiative is the five-year vouchers program. The vouchers, the Administration says, give tenants more freedom of choice as to where they might live. Under the program, recipients must find private-market housing and pay the difference between 30 percent of their income and the "fair market rate," a standard amount set by HUD as the maximum a low-income household should pay for rent. Under the current certificate program for subsidized housing, tenants pay only 30 percent of their income.

The Administration's proposal for fiscal year 1988 calls for 100,000 vouchers. "The program doesn't expand the supply of housing at all," says Douglas B. Diamond Jr., NAHB's assistant vice president for housing policy. "In fact, it expands the competition for the existing supply of housing.

The Administration's emphasis on the "privatization" of public housing portends another potential drain on supply. In 1984, HUD launched a demonstration program encouraging tenant ownership of such housing. Since then, 3,589 units have been sold in 55 formerly subsidized projects. Reactions are mixed. Doug Cavanaugh, legislative counsel for the Council of Large Public Housing Agencies, calls the program "a ruse for unloading the public housing stock on tenants who can't afford to keep it." Apgar calls it a "cruel trick."

As the federal role diminishes, a cutback in multifamily dwellings in the private market also is taking place, as the market moves further and further into the middle- and high-income levels. Between 1970 and 1975, single-family housing starts accounted for 55 to 65 percent of the total; between 1975 and 1980, 70 to 75 percent.

Private development of low-income rental housing is virtually nonexistent. In addition, nearly 100,000 privately owned low-income units are lost every year through abandonment, foreclosure, arson for profit, and condominium conversions, says the National Low Income Housing Coalition.

It is still unclear how changes in investment tax credits brought by the Tax Reform Act of 1986 will affect the partnerships of private investors with nonprofit organizations or state or local housing agencies geared to developing low-income housing, especially where a large private investment is involved. The tax credits remain significant—9 percent annually of the cost of low-income units, minus the cost of land, over a 10-year period. "But they are loaded down with restrictions that will discourage investors, particularly the clause calling for the credits to be taken only on passive income," Diamond says.

It is hard to avoid making the correlation between the decline in the supply of low-income housing and the rise in homelessness. Estimates of the number of homeless now range between 250,000 and 4 million. By the year 2003, unless some drastic steps are taken, 18.7 million could be homeless, burdened with excessive
rents, or forced to live in slums, the Neighborhood Reinvestment Corporation predicts.

To avoid such an outcome, public, private, and nonprofit groups at the state and local levels are forging ahead with new approaches to providing low-income housing. So widespread are these efforts that "local influence on federal involvement may be as strong as the federal influence on local housing and community development activity of an earlier period—from 1934 to 1980," says Mary Nenno, association director for policy development at the National Association of Housing and Redevelopment Officials.

Developer James Rouse puts it this way: "There is a whole uprising out there." New types of partnerships have been formed, new development methods tried, and new financing schemes devised, many of which seem to be more responsive to community housing conditions than the federal programs.

Take Chattanooga, Tenn., for example. Last September the city announced a $200 million plan aimed at providing a decent home to every city resident within the next decade. That will involve the construction of 300 units and the renovation of 13,000. A newly formed group, Chattanooga Neighborhood Enterprise Inc., will lend money and technical assistance to neighborhood groups, churches, and individuals for the renovations. So far, $3 million has been raised from local and national sources to cover the first three years' operations. The effort was spearheaded by local nonprofit and community groups and developed by the Baltimore-based Enterprise Foundation.

Although larger than most, this program is typical of work the Enterprise Foundation has been doing since it was founded in 1981. Its financial base consists of profits generated by the Rouse Company's festival marketplaces, modeled after Quincy Market/Faneuil Hall in Boston and Harborplace in Baltimore, but built in smaller cities such as Norfolk, Va., Toledo, Ohio, and Battle Creek, Mich. The Enterprise Foundation also receives grants from other foundations and businesses. It expects to have raised $25 million by the end of 1987 and will have provided funding and technical assistance to 67 nonprofit community groups.

"We work strictly with poverty-level families where the economics are very tough," says Peter Werwath, director of the foundation's rehab workshop. "The majority of those people live in substandard housing, and the odds against replacing all those units with modern, decent housing are enormous. It isn't a volume program. We're usually trying to demonstrate some new kind of production or financing technique." Emphasis is also placed on strong community services—health care, job training, and education, among others.

A similar organization is the Local Initiatives Support Corporation, which began in 1979 as a joint effort of the Ford Foundation and six major private insurance, industrial, and banking firms. LISC started with a budget of $9.35 million; by the end of 1985 its assets topped $100 million. Its objective is to assist local nonprofit organizations in securing private and public resources for the design, financing, and management of housing and community developments of significant scale. These developments are to be long-term, profitable economic ventures. Special attention is given to assisting low-income households while maintain-

ing middle-income residency in a particular neighborhood.

Housing partnerships have been formed across the nation that assemble funding (and sometimes expertise) from private and public sources and direct it toward a specific low-income housing development. More recently, these partnerships have been formed to develop and manage multiple projects. For instance, the Boston Housing Partnership, formed in 1983, contracts with 10 community development corporations, which in turn are responsible for specific low-income housing initiatives. The Massachusetts Housing Partnership, formed in 1985, set as its goals the reclamation of all salvageable abandoned housing units in the state, redevelopment of abandoned lots, strengthened efforts to maintain households in existing housing stock, expanded housing production, and innovative demonstration projects.

An example of a nonprofit, cooperative venture at the local level is the Nehemiah Plan, established in New York City in 1980. This coalition of 52 religious congregations—the East Brooklyn Churches—raised seed money, secured $15 million in interest-free loans from the state for mortgages, received land donations and short-term suspensions of property taxes from the city government, and built 1,600 single-family houses for families with incomes ranging from $20,000 to $40,000. In the San Francisco Bay area, BRIDGE, a nonprofit regional development corporation, produced 1,466 housing units in six counties for families earning $12,000 to $25,000 per year.

Meanwhile, special revenue-raising programs tied to the development dynamics of a specific market have sprung up. In San Francisco, for example, downtown commercial developers must either produce one low-income unit for every 1,125 square feet of office space or contribute a set fee to the Citywide Affordable Housing Program Fund. The requirement is based on the assumption that each additional million square feet of office space produces the need for 386 low-cost apartments to house the low-paid workers employed in the new buildings. From 1981 to 1986, 3,793 units were funded by this program. Similar programs have been adopted in Boston, Jersey City, N.J., and Santa Monica, Calif.

A fund-raising technique first used in the early 1950s has resurfaced in 35 states—tax increment financing. Under state laws, localities can generate new revenues for future housing and community improvements by taking advantage of an increase in property values resulting from redevelopment. Property taxes are frozen at the start of the redevelopment; at the end, when rates have increased, developers must pay the difference between the frozen level and the full taxes. The funds are used to help pay off the public revenue bond issued to finance the housing.

Other housing trust funds are created by the interest earned on real estate transactions, such as escrow deposits, real estate title transfer fees, mortgage property tax and property insurance prepayments, and commercial and residential tenant security deposits. Nationwide, income from tenant security deposit, sale, and mortgage escrow interest could total $1.7 billion annually, according to the National Association of Housing and Redevelopment Officials—enough to build 39,000 units or rehabilitate 170,000. Some trust funds take an unusual twist. California uses
taxes levied against offshore oil revenues. Atlantic City collects taxes on hotel rooms, entertainment, and other luxuries; gambling casinos are required to invest in low-income housing.

Supplementing the housing trusts, states have generated new rental and homeownership assistance programs, rent supplements, neighborhood improvement programs, and aid to special-needs housing. California, for example, will use the funds from its offshore oil taxes over the next three years to provide seed money for construction of low-income rental housing, grants to organizations providing shelter for the homeless, and loans for housing for the elderly and disabled.

Localities, too, have increased their efforts. It is not unusual to find a local government acquiring or renovating low-income housing, although the programs are usually quite limited in scope. The Houston Housing Authority recently bought foreclosed homes to rent to low-income households. In Alexandria, Va., the housing authority recently purchased 152 units to "ensure there would be some low-cost housing." Under a neighborhood preservation ordinance, the City of Hartford, Conn., requires that anyone wishing to demolish or convert residential units must replace those units with an equal amount of square footage or contribute to a low-income housing fund. In the program's first 18 months, 65 units had been replaced.

Most of these state and local programs will ultimately meet only a small percentage of the need unless there is a significant influx of federal dollars. As of 1982, states and cities were subsidizing about 600,000 households. Currently, about 4.2 million households participate in federal programs.

But in terms of establishing the institutions that may someday be used to fill the needs, the state and local programs are significant, says housing expert Cushing Dolbeare. "The expertise state and local governments and nonprofit organizations have recently acquired in developing and operating housing projects provides a base on which federal programs may soon be rebuilt." Nenno predicts an even larger role: "If carried to fruition, these trends should have a long-term effect of changing the status of low-income housing as an isolated and after-the-fact activity to one of an assured place in the total marketplace." In the future, the availability of low-income housing may increasingly be seen as a key component in a locality's economic revitalization.

Housing experts, though, say it is still essential to have a strong federal role supporting the state and local efforts. Only the federal government, they say, can provide national standards and policies needed to direct private funds into housing. What those standards will be, concerning the construction or rehabilitation of any public housing, is intrinsically tied to costs.

"We imagine we have enough money so everybody can live in good-quality housing," Apgar says. "We set high standards for what we expect our public programs to achieve, and we produce very high-cost housing that becomes more and more like standard subdivision housing. But then we don't follow through and make enough resources available so everybody can get access to the housing."

Kenneth Beirne, HUD's general deputy assistant secretary for policy development, suggests, "The market can build shelter that by worldwide standards would be fantastic for low-income people. By American standards it would be utterly intolerable." In reality, the solution may be somewhere in between.

Kathryn Wyld of the Housing Partnership Development Corporation in New York City, points to bathroom and kitchen size requirements. "By the time you are done," she says, "you've lost the economics."

Partial rehab is an option. "In most cities, 15 to 20 percent of the offshore doesn't even meet housing codes," Werath says. "If you drive a nail and pull a building permit, you are committed to spending $40,000 a unit. Partial rehabs can run from $15,000 to $35,000." Werath says the Enterprise Foundation stresses least-cost, high-value techniques for such tasks as roofing, drywall fastening, caulking, and painting.

Another departure from conventional housing is the reintroduction of the single-room-occupancy hotel. That type of housing—where residents have private bedrooms but share bath, kitchen, and other living spaces—has proved appropriate and affordable for once-homeless persons who do not yet have the means for separate apartments. The building type is highly flexible and can be altered for a specific population, such as the chronically mentally ill, the elderly, or single men or women. Many argue that the single-room-occupancy hotel is a better social environment for these populations than separate apartments. Supportive services, located on or near the residential site, can add a crucial dimension.

By the year 2003, says the Neighborhood Reinvestment Corporation, 7.8 million more units of low-income housing will be needed. "There is a sense that it's time to start putting housing policy back together," Apgar says. "You've got former enemies now working together—builders, bankers, advocacy groups. It's like starting fresh all over again." Spearheading the effort in Congress are Senators Alan Cranston (D-Calif.) and Alfonse D'Amato (D-N.Y.), who in 1988 or 1989 will introduce the first major post-Reagan-era national housing policy. And a number of both Republican and Democratic presidential candidates are talking about what the federal government can and should do to mitigate the impending crisis.

Already, essential elements of future housing policy are clear. Flexibility and diversity are needed to better match scarce resources, "so that where it is cost-effective to rehabilitate, communities will do that, and where it is cost-effective to do new construction, communities will do it that way," Apgar says. Most projects will be community based and small in scale. "Volume production and highly standardized federal programs don't work," Wyld says. Kermit Baker, senior economist for Cahners Publishing Co. in Boston, says, "The federal government has much more ability to raise funds than anyone else. It's difficult for rural Mississippi, for instance, to raise the money for housing. The places that can afford to do that are probably not where the problems are going to be. Without federal aid, you're going to have very, very serious distortions. Whether the feds should administer the programs or not—that's a separate issue."

What is most clear is that "we have to re-establish a longer-term commitment to gradually expanding the number of subsidized, affordable units," in Apgar's words. □
This summer is the 50th anniversary of New York City's first federally subsidized housing project, Harlem River Houses, built during the Great Depression near the New York Giants' Polo Grounds in upper Harlem. With 574 walk-up apartments in three serpentine red brick buildings four stories high, Harlem Houses earned lavish praise from Lewis Mumford, Hon. AIA, who, strongly influenced by Ebenezer Howard's Garden City concepts, wrote: "Here . . . is the equipment for decent living that every modern neighborhood needs: sunlight, air, safety, play space, meeting space, and living space. The families of Harlem River Houses have higher standards of housing, measured in tangible benefits, than most of those on Park Avenue. By contrast, every other section of the city is makeshift, congested, disorderly, dismally inadequate."

Today, the Giants' Polo Grounds have given way to cheerless, stark slabs of high-rise housing. Nearby, along littered Frederick Douglass Boulevard (Eighth Avenue) in the west 140s and 150s, century-old tenement houses stand like giant tombstones—boarded, grimy, threatening.

But in the courtyard of Harlem River Houses off Adam Clayton Powell Jr. Boulevard (Seventh Avenue) at 152nd Street, elderly residents converse softly in the shade of 50-year-old plane trees. A block away, small children are closely supervised in a well-kept playground. And along the project's northern periphery, stuffed animals and bric-a-brac are neatly arranged in ground-level windows protected by burglar bars.

Harlem River Houses is a reminder that humanely scaled public housing, even with abundant green space away from the street (Jane Jacobs notwithstanding), can thrive next to urban decay. "It remains a community," observes John Louis Wilson, FAIA, one of the pioneer project's architects. "When I walk through the courtyard, people ask if they can help me."

Wilson lives a mile away. Now 85 and retired, he was in 1928 the first black graduate of Columbia University's architecture school, and in 1984 he won AIA's Whitney M. Young Jr. citation. He was the only black and is now the only living member of the seven-architect team assembled in 1936 by the New York City Housing Authority to design the project. The chief designer
was Archibald Manning Brown, Harvard- and Ecole-trained architect of city and country houses for the wealthy.

Riots in 1935 had focused attention on Harlem's housing needs, and the Federal Emergency Administration of Public Works agreed to spend $4.7 million for a model project, with the city providing the land. Of the original 574 apartments, 60 had two rooms with kitchenette, 259 had three rooms, 232 had four rooms, and 23 had five rooms. Each apartment had electric refrigeration and lighting, steam heat, cross ventilation, a tile bathroom, and what was considered ample closet space. Wilson believes one of the units' strengths is a circulation pattern with foyers that eliminate the need for going through the living room to reach the bedrooms. "Somebody might have to sleep in the living room," he says. He wanted showers in the bathrooms, but they were considered luxuries. Later, the housing authority installed showers over the tubs.

Well-designed units are one reason several dozen residents have lived there 50 years, like Pearl Carpenter, who moved up from 120th Street in 1937. "My husband and I were so happy with our apartment we were like honeymooners. I still love it," she says. And Josephine Baker, a "newcomer" who arrived in 1956, says, "I wouldn't move from here unless I had to." Indeed, there are stories—perhaps apocryphal—of people refusing jobs that would pay more than the maximum income allowance for residents in the project.

Most important to Harlem Houses' endurance are low density, domestic scale, and intelligent site planning. As countless subsequent projects have proven, no amount of open space can make a community of clustered high rises. Such projects seem to incubate crime, while the courtyard at Harlem River Houses has remained relatively safe, patrolled by tenants and a lone housing authority police officer five days a week. The resulting community pride, in turn, reinforces the benefits of good planning and management. ■
Now GE simplifies the whole difficult business of ordering built-in appliances.
Mexico City as Seismic Laboratory

A multinational team draws lessons from the 1985 tragedy.
By Donald E. Geis and Christopher Arnold, AIA

On Sept. 19, 1985, an earthquake registering 8.1 on the Richter scale struck the central and southwest regions of Mexico. Felt as far away as Houston, the quake severely damaged Mexico City, some 250 miles from the epicenter. More than 20,000 were killed, and damage costs totaled between $4 billion and $5 billion. The total economic losses will greatly exceed this. Approximately 5,700 office buildings, schools, hospitals, and residential buildings throughout the central city were heavily damaged or destroyed.

The quake offers the U.S. and Mexican building communities a revealing, if deadly, “natural experiment.” Mexico City structures used the same modern design and construction techniques for earthquake resistance that are used in the U.S. How did they fare? The answer to this question is vital not only in California but in 38 other states (with 70 million inhabitants) that are susceptible to moderate to high earthquake forces.

In an effort to learn in depth from the experience in Mexico City, AIA and the Colegio de Arquitectos de Mexico/Sociedad de Arquitectos Mexicanos (CAM/SAM) are investigating the Mexican quake with support from a National Science Foundation grant to the Joint Council on Architectural Research. This council is sponsored by AIA and the Association of Collegiate Schools of Architecture. The investigation to date is notable less for uncovering new information than for changing informed speculation into fact and reinforcing again the importance of what we already know:

- A large earthquake is devastating in terms of loss of life and property damage for a modern city.
- The interaction of a building’s form, structure, and construction quality determine its seismic performance. The earthquake unerringly seeks out any weaknesses.
- Well-designed and -constructed modern buildings perform well. To achieve this standard demands a high level of cooperation and understanding among all members of the design team.
- The traditional criteria for a well-planned city coincide with those for a seismically safe city.

Mexico City sits nearly a mile and a half above sea level, ringed by mountains. When Cortés conquered the Aztec city in 1519, this basin was partly a lake, which the Spaniards drained and filled in.

In the centuries since, Mexico City has grown into a modern metropolis of 18 million people. Much of the modern city is built on the high ground surrounding the old lake bed, but the city’s central district remains atop the lake bed’s layers of sediment, which have a high water content. Extensive ground subsidence has been a feature of downtown Mexico City for decades, causing buildings to tilt dramatically, even without earthquake activity. This geologic setting tends to amplify the seismic waves created by distant earthquakes, so that central Mexico City is particularly vulnerable to seismic attack.

Well aware of the nature of the ground and of Mexico City’s extensive earthquake history, authorities first enacted a seismic building code in 1942. Following an earthquake of Richter magnitude 7.5 in 1957, regulations were made more demanding, resulting in a seismic code comparable to any in the U.S. at that time. New regulations, including provisions regarding dynamic analysis, were issued in 1966 and 1977. However, the intensity of the 1985 earthquake exceeded by a wide margin the intensity that had been anticipated in the code. Under these circumstances the question is not why so much damage occurred but rather how so many buildings survived.

While a seismic code provides a technical baseline, how the code is enforced and interpreted is another issue. The authority responsible for drafting codes and issuing construction and occupancy permits in Mexico City is the Federal District Department. Responsibility for complying with code provisions is usually placed with the registered engineer or architect who is given the construction license, and thus department engineers rarely check computations and drawings except in special circumstances. Mexican sources comment that a great deal of freedom has been given in the design and supervision of construction of privately owned buildings. This has led to a tendency for building codes to be regarded by Mexican engineers more as guidelines than as rigid regulations.

In the Pacific Ocean, about 250 miles from Mexico City, a section of the earth’s crust, the Cocos Plate, moves roughly three inches a year as it thrusts itself under the Mexican land mass. In September 1985, this plate suddenly broke away from Damage to two older office buildings (left) was repaired in 18 months. The structures were reduced in height and restored (right).
the adjacent crust, lurching between three and six feet. The resulting initial earthquake, of Richter magnitude 8.1, was one of the most powerful in history. In the days following, dozens of smaller ruptures occurred as the plate continued to release energy. The largest, of Richter magnitude 7.5, came 18 hours after the first quake.

On the outskirts of Mexico City, instruments recorded maximum accelerations of .04g. (One “g” is the acceleration of a free-falling body due to gravity.) In the soft ground of the center city, accelerations rose to .16g. These accelerations are not particularly large; a maximum acceleration of 1.25g was recorded in the 1971 San Fernando, Calif., earthquake. But the Mexico City motion continued strongly for over a minute (compared with 10 seconds in San Fernando) and the seismic waves vibrated slowly at about a 2-second period. This period corresponded to the natural frequency of buildings of six to 20 stories, causing the forces in many of these buildings to be amplified to the extent that, toward their roofs, they sustained accelerations of as much as 1.0g. It was this amplification, combined with the long duration of the shaking, that caused the damage.

Could such destruction occur in the U.S.? The evidence is not conclusive, but ground conditions in the San Francisco Bay area, the Los Angeles basin, and certain areas of the central states give cause for concern that, under certain kinds and distances of earthquake source activity, some of the Mexico City phenomena might indeed occur in the U.S.

Because of the nature of ground conditions in Mexico City, the earthquake damage was confined to an area of approximately 25 square miles, with severe damage concentrated in a zone of approximately 9.5 square miles. Little damage was done in the rest of the 385-square-mile metropolitan area. Of some 5,700 buildings listed as damaged, 950 were destroyed, 2,300 were severely damaged, and 2,450 suffered medium to minor damage. Sixty-five percent of the buildings were residences, 12 percent were schools, 6 percent were offices (public and private) and 0.7 percent were hospitals.

These percentages can be misleading as to the effects of damage on the city. The damage to hospitals (five destroyed and 22 severely damaged) represents a loss of about 30 percent of the available hospital beds. Damaged government and other public buildings forced the relocation of about 150,000 public servants. Total housing losses of some 76,000 units added to an already present housing deficit of 30 percent. Approximately 6,000 deaths were officially recorded, though the actual figure (including unrecorded casualties) may be three to four times as much. Forty thousand people were injured.

Further analysis of building damage shows that 26 percent of the buildings severely damaged or destroyed were constructed before 1957, 56 percent between 1957 and 1976, and 18 percent after 1976. While only 1 percent of one- or two-story buildings were damaged, buildings of six to 12 stories suffered an average damage rate of 11 percent.

The most vulnerable building type was the medium-height, reinforced concrete structure with no structural (shear) walls, employing a flat slab or waffle slab floor structure. Buildings of this type failed at the columns or failed because of insufficient strength of column-to-floor joints. But a more significant cause of failure lay in characteristics of building shape, planning, nonstructural components, or loading that created torsion or stress concentrations that the structural members or connections could not withstand.

Architecture, structure, and construction

The earthquake “sees” and tests the whole building; it does not distinguish among the contributions of the architect, engineer, and builder. In studying building failure in Mexico City, it is useful to categorize four patterns: collapse of top floors, middle floors, bottom floors, or the whole building.

Engineering investigators from Mexico City University found that 38 percent of the seriously damaged buildings suffered an upper-story failure. This can be attributed to whipping action as the earthquake motion is amplified in the upper stories of a building. In some cases, architectural or structural irregularities contributed to the failure: a change of column size or the introduction of irregular framing or unusually flexible columns. Modern U.S. seismic codes require a more even distribution of a larger percentage of the seismic forces to the upper stories of a tall building to help prevent this problem.

The Mexican engineers found that 40 percent of the seriously damaged buildings suffered middle-story failure. Most frequently, this was caused by pounding from an adjoining building vibrating out of phase so that the buildings struck one another. While pounding has long been recognized as a problem, the extent of pounding failures in Mexico City demonstrated that it is a major problem. Current codes impose limits on drift, or the extent of lateral deflections. In theory this should protect against pounding, but in practice the code drift limits do not represent possible actual motion. To separate buildings to the extent necessary to protect against pounding, the space between buildings needs to be very great—on the order of five feet for a 12-story building—and this presents real estate and urban planning problems.

At the same time, it is clear that many buildings in Mexico City were protected from collapse because they were erected hard up against the adjoining buildings on both sides, so that whole blocks acted as a unit and strengthened the individual buildings. As evidence of this, the Mexican studies show that 42 percent of heavily damaged buildings were corner buildings, lacking the protection of adjoining buildings. This finding necessitates serious thinking about allowable drift, pounding, and the design of closely spaced buildings.

Weak first stories accounted for 8 percent of building failures. The percentage is probably much greater because many of the total collapses were precipitated by this characteristic. But in buildings with weak first floors and stiff upper floors—created generally by open planning in the first floor to accommodate stores or lobbies—often the upper floors retained enough integrity to survive. The Mexico City experience reaffirmed the risks of this configuration, particularly for heavy frame structures lacking in resisting walls.

It is harder to diagnose the failures of buildings that totally collapsed. In many cases, no single cause predominated. Irregularities in plan or loading may have combined with a weak first floor, with inadequate connections, or with construction deficiencies to result in collapse. When an occupied building collapses, heavy loss of life is inevitable, and the niceties of analyzing building damage cease to be of concern.

The failure of many damaged buildings could be traced, at least in part, to asymmetry in plan, whether of overall form or in the location of stiff elements such as stairs or walls. One example of this explicitly shows the relation between architectural form and the form of the city—in its street pattern. Buildings that were triangular or wedge-shaped in plan suffered badly. Typically these were on tight urban sites created by streets.
interacting at an acute angle. This form is common in U.S. cities, where our rectangular grids are intersected by diagonal streets. The wedge-shaped building often has a solid party wall and two open sides—a prescription for torsion, the most difficult building motion to counteract.

While analysis of the huge stock of Mexico City’s damaged buildings is instructive, the successes must not be forgotten. One of these is the Torre Latino Americana, a 48-story building designed in 1948. The personal experience of its engineer, Adolfo Zeevaert, still active in his 80th year, gives a graphic impression of the earthquake in this building: “I was sitting at my desk selecting photos, when I began to experience a minor movement. About five seconds later my chair suffered a large displacement of approximately two feet (my chair is on casters on a plastic sheet). All the pictures on the wall moved. I stood up and walked with difficulty to the corner of the room, looking south. Only eight seconds had passed from the first movement of the rocking action.”

“The earthquake was over! I started to worry about possible damage to the tower; the movement was very strong.”

In fact, this building suffered five broken windows, minor damage to contents, and minor cracking in partitions. The elevators had to be checked but were back in service in two hours. This building is famous in seismic design circles for the careful integration of its structural and architectural design, and its performance in earthquakes justifies this regard.

The new national lottery building, of triangular plan form, has a very tall first story—a conscious act of urban design that opens up the public space at an important corner—and an offset elevator core. The building also uses a complete floor-to-ceiling glass curtain wall of great delicacy. This building, a block and a half from some of the worst damage in the city, was undamaged. This example shows that knowledgeable engineering and architectural collaboration can make completely safe an otherwise questionable set of architectural concepts.

There are so many examples of both good and bad performance in Mexico City that only a systematic study of a large building inventory, in which configuration characteristics are accurately identified and correlated to degrees of damage, will make adequate use of all the information.

The earthquake resistant city

The complex series of design, development, and management decisions made by design professionals, public officials, developers, and others has become more fragmented over the years because of specialization. The result is a lack of coordination by the players making decisions.

The problems experienced in Mexico City as a result of its explosive and largely uncontrolled growth were evident in familiar environmental deficiencies. The traffic congestion, lack of open space, pollution, and stocks of poorly built high-density houses are characteristic of the present environment of many of the world’s huge cities. It is worth pointing out that these same deficiencies result in a city that responds poorly to a great earthquake and the ensuing destruction.

Inadequate design and construction and high density lead to casualties and multitudes left homeless. Congested streets and lack of open space result in impeded access during an emergency and a scarcity of sites for emergency shelter, temporary housing, and debris disposal.

Ironically, recent history has shown that earthquakes ultimately are beneficial in remedying a city’s faults. In a ruthless way, the earthquake damage results in an instant redevelopment that normally is achievable only over decades of legislative and bureaucratic process.

The continuing story of Mexico City, as it rebuilds and reconstructs, will show the extent to which it takes advantage of the destruction. Already the congested downtown has gained small parks where buildings, or even blocks, were demolished. Proposals to limit building height to four stories in the historic core are under consideration. We still have much to to learn in studying the progress of these measures.

So, Mexico City remains as a living laboratory of a disaster—initiated by nature but redeemed by human construction. The problems, the lessons, and the solutions are so complex, affecting all aspects of the physical, social, economic, and political environment, that we have no experience and no clear rules upon which to base our activities. The possibility of a disaster on the scale of Mexico City’s certainly exists for an American city: it would be different in its details but the same in its gross impact.

Where do architects stand? Worried about their role, beset by issues of liability, and unsure of the scope and force of their decisions, perhaps the last thing they want to think about is an earthquake. But Mexico City has made it clear that architects, with their colleagues in the design and construction industry, share responsibility for disaster. To the extent that architects wish to lead the building team, they must understand the forces of disaster and work toward reducing them.
After Mexico City was struck by a major earthquake in September 1985, the government, faced with the trauma of some 20,000 lost lives and $5 billion in lost property, immediately put into motion a series of plans that would result, 18 months later, in one of the largest housing reconstruction programs since the end of World War II. The program, called Renovacion Habitacional Popular, is outstanding in four respects: (1) its social plan, which reinforces rather than disrupts social networks; (2) the speed of its new housing construction; (3) the generous design and solid construction of its prototypes; and (4) the efficiency of its financing through a huge World Bank loan combined with aid from local Mexican financial institutions.

Less than a month after the earthquake, Mexico's President Miguel de la Madrid Hurtado used emergency powers to expropriate many privately owned housing sites in the destroyed areas. Owners were compensated for their lost property; and resident families, which for generations had been renters, would now have the opportunity to purchase their new housing units from the government and to become homeowners for the first time. Thus having set the tone for social as well as building reconstruction, the government conducted extensive physical and social surveys and set a budget.

As a result of the surveys, city planners limited the area of reconstruction undertaken in this program to the three boroughs of Cuauhtemoc, Venustiano Carranza, and Gustavo Madero, which housed approximately 250,000 of the 18 million inhabitants of the Mexico City metropolitan area. These people lived in 44,437 units to be repaired or replaced.

Many of the expropriated properties had been, prior to the earthquake, in a condition of great decay. Because of rent control laws passed in the 1940s, which kept rents as low as $3 per month, landlords had been reluctant to make repairs on housing units. Social surveyors observed that the average size of the damaged units was 200 square feet, that 63 percent lacked toilets, and that 20 percent shared kitchen facilities. However, the surveyors found to their surprise that the age of the average head of a household was 44 years, mature compared with a national average of 27 years, that families were smaller than anticipated, averaging only four members, and that the average income for the head of a household was twice the minimum wage of $90 per month. It was the relatively small size of the families plus their relatively high income that, in the end, made the home-purchase approach successful.

Though the families were poor by North American standards, they had a history of steady work and of extended family networks in the same neighborhood for generations, which made family life far more secure and rewarding than might at first be apparent. In addition, free schools and free medical services substantially enhanced the quality of life in Mexico City's downtown barrios.

Ann Ferebee is the founder and director of the Institute for Urban Design, operating out of New York State. Eduardo Terrazas is an architect practicing in Mexico City who has also taught in the U.S.
Based on these findings, the planners devised a social strategy that emphasized reconstruction of dwellings on the same plots and for the same tenants who had lived in the original buildings. In this way, family and social networks could be maintained without disruption. In effect, Mexico City adopted a policy diametrically opposed to the new-town policy carried out in England after World War II with disruptive social consequences. The Mexico City reconstruction demonstrates that reinforcement of social ties is as important as provision of new housing stock and that new housing will accomplish little without effective family structure.

Mexico City’s social strategy was implemented in May 1986 by more than 100 organizations, including earthquake victims; government and private agencies, such as the Red Cross; technical groups including architects; universities; and financial organizations, the most important of which was the World Bank.

The financial strategy originally provided for about $400 million in loans from the World Bank. The strategy also established the reconstruction budget within Mexico’s national budget, thus requiring cuts in other parts of the national budget. The combination of international with national funds proved effective: in the end, only 20 percent of the total reconstruction budget of $600 million came from international loans. The budget was administered by computer and subject to frequent audits.

The reconstruction program had several crucial elements: (1) all new housing units would measure 400 square feet, almost double the size of the pre-earthquake units; (2) each unit would have two bedrooms, a bath, a kitchen, and a space for washing; (3) former renters now buying their housing units as condominiums would pay only the basic construction cost of $3,000; and (4) loans to purchase the units would be made available to the former tenants, with monthly payments amounting to about 30 percent of the minimum wage, or $20 to $25 per month, with most loans anticipated to be paid off in about six years. Edward Echeverria, a senior planner at the World Bank, explains that, because inflation in Mexico runs at the rate of 100 percent a year, it was considered crucial to tie the home loan repayment rate to the minimum wage.

A technical strategy, implemented in tandem with the social strategy, made possible within 12 months the demolition and reconstruction of 34,500 dwelling units, repair of 2,500 units, and upgrading of another 3,000 units. At the heart of the technical strategy was a decision that each 400-square-foot unit should follow one of seven prototypes, each of which would be built on a concrete foundation slab with prefabricated, steel-reinforced concrete walls. To make them as safe as possible, the height of the new buildings was limited to three stories. While each unit was supplied with electricity and water, the warm climate made it unnecessary to supply heating. Further labor and time savings were realized by putting stairways on the exterior of buildings. Together, these factors made it possible to build each unit for $3,000.

During reconstruction, a provisional housing program provided several options for housing the displaced population. Approximately 10,000 units in Mexico City’s public housing program were turned over immediately to families whose housing had been destroyed. In addition, provisional housing was set up in parks and on the streets for families from about 4,000 units of totally collapsed housing. The mild climate contributed to the ease of living in the temporary shelters. The situation could have been worse, as one housing consultant commented: “What would have happened if the quake had erupted in Toronto?”

The tin-built temporary shelters, fully serviced with social workers and doctors, were protected from auto traffic by chain-link fence and from crime by a 24-hour security patrol. Each family was given the option of living in the temporary tin shelters or, with a rent supplement from the government, locating its own temporary rental unit with relatives or friends. In the end, some 19,000 families found subsidized rental units. About 22,000 families elected to live in the temporary tin shelters. In addition, many privately owned damaged buildings were rehabilitated by their owners, often with effective cooperation between tenants and landlords.
Whether living in street shelters or temporarily renting rooms from relatives and neighbors, families watched the construction of their new homes day by day. Steel reinforcement was left exposed to reassure families of the safety of the new units, built under tight new construction codes.

Because much of Mexico City rests on the sandy bed of what centuries ago was a lake, soil mechanics proved to be a particular challenge. To compensate for the unusual degree of compression in the sand that is typical of Mexico City's terrain, special soils were brought into many of the construction sites. *Tepetate*, a heavy yellow soil, was brought in from the edge of Mexico City's lake bed. *Tezontle*, a light but rigid red volcanic soil, was brought in to balance the *tepate* and natural sand in many of the sites.

When they moved into their new units, many families had private baths for the first time. Said one new homeowner, "My new home is beautiful. Before we had just one room with an awning. Now we have two bedrooms, living and dining rooms, kitchen, and bath. It makes me happy because later on my children can live in it." Another owner said, "I'm so happy because, after living and sleeping in the street, we have a home now. It's fair enough what they ask us to pay."

Pride in ownership is reflected in the personal details that enhance the individual housing units (left and above).

The reconstruction design strategy also addressed the issue of urban image, of how to tie the raw new reinforced-concrete dwellings back into the urban fabric of a city whose 2,000-year-old Aztec ruins form a backdrop for Spanish baroque cathedrals and Mediterranean-style housing. The answer was color. The new housing units were washed in a bright palette of red, orange, lavender, ochre, and green. And, equally important, proud homeowners have hung bird cages outside their front doors and have planted the courtyards.

Because the earthquake did its most severe damage in the center of the city, where the greatest number of historically significant buildings were located, historic preservation became one of the greatest challenges of the reconstruction program. Complete historic preservation was neither economically viable nor practical within the time frame of the program. Each damaged historic building was evaluated individually, and, at a minimum, the facade was restored while modern materials were used to ensure stability. To the dismay of hard-line historic preservationists, some of the historic buildings have been repainted with the bright green, orange, and lavender colors used for the new housing units.

The successful completion of the reconstruction program in 18 months (only three months off the goal) was due in part to the small size and efficient structure of the reconstruction team. The team coordinated the work of 1,350 firms and construction funds of $1 million a day to complete 130 dwelling units a day, among other projects. A happy by-product of the earthquake disaster was the generation of some 120,000 new jobs.

On February 7, 1987, *Renovacion Habitacional Popular* received the coveted Robert Matthews prize from the International Union of Architects for the best low-cost housing program submitted to the jury in 1986. When the second anniversary of the earthquake is marked next September, North American professionals, in their search for low-income housing solutions and shelter for the homeless, might look to Mexico City for workable strategies. (Overleaf, a reconstruction showplace.)
Rebirth of a '60s Monument

In the late 1950s, Mexican architecture acquired worldwide recognition due to efforts to solve the growing housing crisis in Mexico City by constructing huge high-rise housing projects in the city and around its perimeter. Although this approach to solving urban housing problems is now generally discredited, primarily because of the social and economic disruption it causes, the Mexican achievements were and still are remarkable.

Largest and most ambitious of these projects (and the largest housing complex in Latin America) was the Tlatelolco housing community, constructed close to the center of the city and completed in 1963. Designed by Mario Pani, Tlatelolco had 102 apartment buildings, 22 schools, five hospitals and clinics, two theaters, three community centers, and three nurseries, plus convenience stores in the first floors of some of the apartment buildings. Officially, the complex housed 70,000 persons in 11,900 units, but the actual number housed was probably much larger.

The Tlatelolco housing community was severely damaged in the earthquake of September 1985. The total collapse of two-thirds of one block received wide publicity because of the disastrous loss of life—approximately 2,000 persons—and because relatives of operatic tenor Placido Domingo were involved. Although this building was the only one of nine of its kind to collapse, the overall damage created a major problem of homelessness of survivors and forced the Mexican government to face a major decision. Should it abandon the complex or rebuild it at what clearly would be enormous expense?

The safest and most economical solution to the problem posed by the damage would have been to abandon the buildings and either rebuild on the site with different types of buildings or move the residents elsewhere. However, in view of the prominence of the site and the fact that since the earthquake the complex had become a forceful political community and had acquired considerable political leverage, the government decided to demolish six buildings that were irreparable and to repair and strengthen all the others.

As a result, Tlatelolco is now a showplace of reconstruction. Sixty buildings are undergoing repairs to finishes and mechanical equipment with the occupants still in place. Thirty-two buildings are undergoing major structural repairs, including, in some cases, removal of the upper floors from tall buildings to reduce their response to ground motion. For the buildings undergoing major repair, the occupants must be relocated and rehoused for an estimated 15 months. Estimates of cost approach a current expenditure of $1 million a day.

In the first months after the earthquake, authorities were heavily criticized by the Tlatelolco residents for their slowness and lack of response. Now the reconstruction project is being criticized for its expense and its role as a showplace, but the effort being expended is certainly impressive to the observer. It is also impressive to see this great 1960s experiment in social housing experiencing a rebirth and rejuvenation, and to see the energetic 75-year-old Marco Pani heavily involved.

Understandably, after the earthquake, no engineer wished to take chances. The structural renovations are massive, including, in the case of a number of huge, 13-story apartment buildings, the construction of a complete exterior reinforced-concrete frame using massive beams every third floor, projecting shear walls, a huge outward extension of the foundation, and new ties right through the entire building. —Christopher Arnold
Chinese City Starts Over After Quake

Totally leveled, Tangshan is replanned as well as rebuilt.
By Christopher Arnold, AIA, and Henry Lagorio, AIA

In the summer of 1976, the city of Tangshan in the People's Republic of China was destroyed by a devastating earthquake, and hundreds of thousands of lives were lost. By 1986, when the city remembered the 10th anniversary of the earthquake, it had been reborn as an entirely new metropolis that had redressed many of the problems of the old city while preserving some of its stronger qualities.

Tangshan is a major industrial city in Hopeh Province on the railway line that connects Beijing, Tianjin, and the coast. The city was founded in the 1870s, when the Kailuan coal mines were started. These mines accounted for 10 percent of the country's fuel and, with other industries including a steel mill, railway locomotive factory, cement and ceramic plants, and aluminum and refractory brick production, gave Tangshan an important role in China's recent economic development.

In 1949 Tangshan's population was 470,000; by 1976 it had grown to 1.6 million, and during this period its production increased 220 fold. The development of the city had not been controlled, and new districts were added to the perimeters of the original urban center at random without adjustment to street patterns. The transportation system was particularly complex, and it was most difficult to circulate through and around the city.

Typical of cities in mainland China, Tangshan was built mainly of unreinforced bearing-wall masonry constructed with brick produced locally. Of the dwellings, 80 percent were single story; the remainder were predominantly two to four stories high, with some as high as eight stories. With few exceptions, these buildings were not designed to be earthquake resistant.

A year before the Tangshan earthquake, a large earthquake struck the city of Haicheng, 250 miles east of Tangshan. This earthquake had been preceded by unusual phenomena, including small shocks and changes in geomagnetism and water levels in local wells. In response, the city had been put on alert, with people evacuated from their homes and sent out into the streets, emergency duties assigned, and disaster relief facilities organized. Although substantial building damage occurred, thousands of lives probably were saved by these precautions.

Similar studies had been going on in the Tangshan and Beijing areas, especially since 1970. In 1974 earthquake warnings were issued and some evacuation took place, but no earthquake occurred. Seismologists noted continuing changes in the area. Long-range predictions were issued in early 1976, and the populace was warned by radio to prepare for an earthquake. However, the evidence was not conclusive enough to result in any short-range predictions before the quake. It therefore struck without warning on July 28, 1976. Its Richter scale magnitude was 7.8, and its epicenter was directly over the southern part of the city.

More than 95 percent of the buildings in Tangshan either collapsed or were so severely damaged that they had to be abandoned. Only one major building survived in good enough shape to be useful during the recovery period. Some of the few buildings that remained partially intact but beyond repair after the earthquake have been left standing in their critically damaged condition and are intended to be seen as historical monuments to the event and to serve as memorials to the dead.

Within the city limits of Tangshan, more than 140,000 people perished and more than 81,000 were hospitalized with severe injuries, while more than 250,000 died in the entire region of the earthquake. This ratio of deaths to injuries contrasts dramatically with that of, say, the San Fernando, Calif., earthquake of 1971, in which 58 people died and 2,400 were injured. The difference can be attributed to the predominance in Tangshan of unreinforced masonry structures, which for the most part suffered sudden and total collapse. Moreover, because the quake occurred at 3 A.M., many people were trapped in bed without even a few seconds warning to seek shelter.

Approximately 30,000 miners on the night shift were underground when the quake struck. Miraculously, all eventually made their way to safety, though some were underground for as long as two weeks. The huge rolling stock factory was destroyed and every building at the Institute of Mining and Metallurgy collapsed, killing more than 100 students and teachers in residence.

The earthquake cut off the power supply, but by the next day power was restored through rerouting of the network. Potable water service did not resume until 12 days after the quake. Communications were entirely cut off due to building collapses and damage to equipment and lines. Some emergency communication to Beijing was restored by late morning the day of the quake. Road traffic was blocked in both Tangshan and Tianjin as debris filled the narrow roads.

Both the natural gas and liquefied gas tanks were slightly damaged, and gas supply was resumed only in late August. At the Tangshan airport, buildings were severely damaged but runways were still usable. In terms of damage and casualties, the disaster at Tangshan was comparable to that of the atom bomb attacks on...
thousand temporary dwelling units were provided within three
months. The central section of the former city remains a relatively open area and the predominant commercial and cultural core. It contains department stores, a 16-story tourist hotel, shops, hospitals, and a large formal park that also contains recreational facilities. Areas have been developed between buildings as permanent open spaces. The resident population will be limited to 250,000.

Provision of adequate housing is one of the main goals of Tangshan’s reconstruction. The new principal residential district, to the north, has been divided into 118 small living communities, which accommodate a population of 5,000 to 10,000 each. Schools, a nursery, theaters, and shopping have been provided in each residential quarter. The individual apartment

Views of the rebuilt city are shown above, this page and opposite page. Below, rebuilt housing is constructed of many materials. Below, opposite page, a damaged building left as a memorial.
rooms, which vary from one to three bedrooms, have a living area of 450 to 550 square feet plus a private balcony, private kitchen, toilet cabinet, gas fitting, and heating radiator.

Afforestation is arranged in the urban districts and subdistricts with an area of 64 square feet per capita. There are 16 parks—eight in the urban district and eight in the subdistrict. Along the riverbanks and roads, embellishment is well under way. The squares between houses also are decorated with flowers.

Several construction methods are used for the new residential buildings: interior poured concrete shear walls with brick exterior; interior poured concrete shear walls with exterior precast concrete panels; brick walls with reinforced concrete columns at the intersections of longitudinal and traverse walls; reinforced concrete frame with light infill walls. These types, where they existed previously, proved to be relatively earthquake resistant and suffered only light damage. The four- and five-story buildings are designed as walk-ups without elevators. Some higher blocks of six to eight stories were also built for visual variety.

One of the fundamental objectives in planning the new city was to develop an organized transportation system (the old one was tortuous and had few exits from the city) to allow easy egress in all directions and unconstrained access to all parts of reconstructed Tangshan. Accordingly, two main arteries, approximately 200 feet wide, have been developed as the principal means of circulation. Within each right-of-way, 50 feet have been developed for autos and buses, 5 feet devoted to a divider strip, 25 feet allocated to bicycles, and 20 feet devoted to pedestrians, each way. All major buildings in the reconstructed city are located along these two main arteries.

A special lane for bicycle riders only connects residential areas to industrial areas. The main railway line has been rerouted to avoid coal-bearing ground; a new station has been built, and the original rail line has become an industrial track.

The layout of the new city has been much influenced by geological exploration, surveys of water sources, identification of areas of potential seismic activity, and vulnerability analyses. Tall buildings and important service facilities have been built on shallow bedrock of high bearing capacity. In order to facilitate evacuation and avoid injuries due to structural collapse, ample space is left between buildings. Wide streets were planned to prevent traffic congestion and to help provide adequate access to disaster-stricken areas, and to remain free of blockage from wrecking operations by emergency fire and rescue teams. In order to reduce the occurrence of secondary hazards, chemical and engineering enterprises and hazardous-use warehouses have been located outside the urban area.

In addition, the Tangshan plan follows a policy in China that emphasizes development of new small cities in preference to the expansion of existing large urban areas. The form of the new city departs radically from that of the old and really represents the sort of rational planned city that Western planners have advocated as long as their trade has existed but have never executed in a form as complete as Tangshan.

What does Tangshan look like, and how does it work? In appearance the new city resembles the planned areas of American and European cities of the '50s. Rows of rectangular blocks of mid-rise apartment houses are generously spaced in a green landscape, interspersed with neighborhood centers and schools. The traffic pattern is planned; the roads are wide with avenues of trees; the obliteration of open space by parked cars is not provided for and probably not anticipated.

While Western planners now are fascinated by low-rise, low-density developments, the Chinese, with plenty of land and 2,000 years of experience in this urban form, are ready for a change. Already, the impersonal apartment blocks are undergoing a peculiar Chinese personalization: balconies are used extensively, and gardens and private storage buildings are appearing at the base of apartments. The older apartments already look more like apartments in old Hong Kong, Canton, or San Francisco's Chinatown than like those in a European new town.

The Chinese economy is such that architects still must concentrate on essentials and are not free to engage in the exploration of form that is popular in the West. However, architecture students avidly read the architecture magazines from the West, and they question Western visitors about postmodernism.

Uninhibited by Western systems of private land ownership and use, the Chinese have taken the opportunity to correct the deficiencies of land-use planning, high density, and traffic that beset old Tangshan. The Chinese have gone much further than planners elsewhere in Europe after World War II, or in the reconstruction of earthquake-damaged towns such as Skoplje, Yugoslavia. It is unlikely to work perfectly, but the new Tangshan should be a much more human and pleasant city than the old, except to those visitors with a romantic attachment to narrow streets, stone walls, and overpopulated rooms.
The Coming Changes 
In Earthquake Codes

They will require sharp changes in designers' thinking. 
By Delbert B. Ward

Architects should prepare for significant changes in seismic design standards of the International Conference of Building Officials' Uniform Building Code (UBC), possibly as soon as the next (1988) edition. A complete rewrite of the UBC's renowned "Chapter 23" seismic provisions now faces scrutiny by ICBO members and others. It reflects more than a decade of accelerated earthquake research.

Although research typically is far ahead of the building codes, the proposed changes in the UBC are just one manifestation of how the new research findings are being applied. The so-called "Blue Book" on seismic design by the Structural Engineers Association of California (SEAOC), recently rewritten, is also now under review. The Building Seismic Safety Council (BSSC) recently published completely new seismic design standards entitled "NEHRP Recommended Provisions for the Development of Seismic Regulations for New Buildings." These provisions were developed under the National Earthquake Hazards Reduction Program (NEHRP) and are being promulgated by the Federal Emergency Management Agency.

If adopted, the proposed revisions in the UBC will mandate some adjustments in thinking by design professionals. First, the methodology for establishing seismic forces under the revised provisions is quite different from the current UBC "seismic equation." Second, the proposed new provisions deal much more deliberately with the influence of building configuration on seismic performance, a topic that is especially important to the architect's role in building design.

These changes need not cause distress among designers if they are viewed simply as an acknowledgment of advancements in seismic design knowledge. Informed architects no doubt realize that seismic design practices heretofore have been as much an art as a science, lacking the degree of precision desirable for a regulatory process, and that a great deal of engineering judgment and experience have been necessary supplements to the seismic provisions of the code. While such judgment and experience will be as valuable under the proposed revised code, instances of ambiguity should be greatly reduced.

Del Ward is a consulting architect in Salt Lake City. He serves on the EERI board of directors and is the former director of the Utah Seismic Safety Advisory Council.

First attempts to incorporate recent seismic knowledge into construction standards were manifested mostly in minor (but sometimes important) changes in selected sections of existing codes. Such changes have included revisions of seismic zones, addition of factors giving consideration to effects of soils on building response to ground motion, and revisions to confinement requirements for reinforced concrete columns. It is important to note, however, that the basic equivalent static methodology, set forth initially in the UBC and subsequently in similar form in other codes, was retained through the years. New knowledge was simply incorporated into the existing format.

Architects familiar with the seismic provisions of the current codes will find that the proposed revisions to the UBC (and even the "NEHRP Recommended Provisions") include basic changes in form—differences in equation formats, factors, and ranges of values for the factors—as well as changes in substance. Similar building characteristics and dynamic properties are used in both the old and new methodologies; for the most part, they are simply quantified differently. Most basic principles of the older methodology have not changed, except to be made more precise. One example of improved precision is in more definitive specification of the vertical elements of the principal lateral-load-carrying structural system. Analytical methods to be used, based on building importance and configuration, also have been prescribed more precisely in the revised provisions.

The last decade's advances in understanding the effects of earthquakes on buildings resulted at least partly from intensified research made possible through the national Earthquake Hazards Reduction Act of 1975. The advances also resulted from more systematic examination, by a growing body of interested private practitioners, of building performance during earthquakes. The enhanced and hastened research has led to a better understanding of earthquakes not only in the fields of seismology and geology but also in architecture and structural engineering. Significant advancements include these:

- Regions of earthquake risk are better defined than they were a decade ago.
- The effects of soils on ground motion are better understood.
- Concepts and details of structural design have been tested in laboratories and in actual earthquakes to some extent, and adjustments in practices have been modified based upon the findings.
- And, of particular importance to architects, the significant role of building configuration in seismic performance has been clarified.

First attempts to incorporate recent seismic knowledge into construction standards were manifested mostly in minor (but sometimes important) changes in selected sections of existing codes. Such changes have included revisions of seismic zones, addition of factors giving consideration to effects of soils on building response to ground motion, and revisions to confinement requirements for reinforced concrete columns. It is important to note, however, that the basic equivalent static methodology, set forth initially in the UBC and subsequently in similar form in other codes, was retained through the years. New knowledge was simply incorporated into the existing format.

Architects familiar with the seismic provisions of the current codes will find that the proposed revisions to the UBC (and even the "NEHRP Recommended Provisions") include basic changes in form—differences in equation formats, factors, and ranges of values for the factors—as well as changes in substance. Similar building characteristics and dynamic properties are used in both the old and new methodologies; for the most part, they are simply quantified differently. Most basic principles of the older methodology have not changed, except to be made more precise. One example of improved precision is in more definitive specification of the vertical elements of the principal lateral-load-carrying structural system. Analytical methods to be used, based on building importance and configuration, also have been prescribed more precisely in the revised provisions.
Some of the changes are, in fact, simplifications of the existing UBC methodology. One such example is direct specification of a seismic zone factor in the revised procedures, wherein the factor used is an approximate value of the effective peak acceleration. This contrasts with the current UBC, in which the value of the seismic zone factor (Z) is obtained differently and is actually a different coefficient from that in the revised methodology, although both are called “Z.”

While discussion of all the changes proposed for the UBC seismic code is beyond the scope of this article, the following changes should be of special interest to architects.

1. The basic seismic equation for determining the base shear has a new form and newly defined coefficients (see box).

2. In the new seismic equation, the numerical coefficient $R_w$ replaces the current K-value for characterizing the primary horizontal-load-carrying structural system. Both K and $R_w$, however, are based on the horizontal-load-carrying system of the structure, though they appear differently in the two seismic equations and their values are quantified differently. Consequently, architects will need to become more knowledgeable about the many possible lateral-load-carrying structural systems and the characteristics of these different systems so that design and details fulfill the requirements of the system for a particular building.

3. Building configuration, classified either as “regular” or “irregular” in the revised UBC methodology, becomes a significant factor in the design process, and specific provisions for design and analysis methods are prescribed for irregular structures. Architects will be compelled by the proposed regulatory provisions to consider more carefully the effects of building configuration upon seismic performance for their creations.

4. The revised provisions will require more rigorous analytical methods for buildings classified as “important” (for example, hospitals, police stations, and fire stations) and for irregular buildings. Furthermore, situations where this analysis will be more situations where dynamic or quasi-dynamic methods are required. Consequently, architects will need to become more knowledgeable about the many possible lateral-load-carrying structural systems and the characteristics of these different systems so that design and details fulfill the requirements of the system for a particular building.

The immediate adjustments in format that would be brought about by the proposed UBC changes are apparent, but the long-term implications of enhanced seismic research on building regulation are more difficult to predict. Some of the patterns that are emerging include:

- Uniformity among codes and standards. One noteworthy aspect reflected in the revised UBC seismic provisions is that the seismic design procedures of the various codes and standards are moving in the direction of greater uniformity. Specifically, the proposed change for the Z factor brings that part of the methodology into the same form as it appears in ANSI A58.1 (1982). Moreover, the UBC $R_w$ factor (which replaces K in the seismic equation) is a further simplification of that portion of the methodology outlined in the “NEHRP Recommended Provisions.” Although there is much still that could be done in this regard to achieve uniformity among seismic codes and recommendations, this is a significant first step.

- Regarding the possibility of the revised provisions eventually leading to a national seismic standard, most of us have heard talk in the past of a “single national building code” that has never materialized. Nonetheless, the prospect that a national standard for seismic design might evolve will gain even more momentum in the next few years as the UBC provisions, if adopted, are worked with and tested in the field.

In this regard, the Earthquake Engineering Research Institute (EERI) has moved in the direction of encouraging consideration of a national standard for seismic design. Robert V. Whitman (the EERI president in 1985-87) addressed this subject in an article appearing in the July 1986 issue of the EERI newsletter (Vol. 20, No. 7). Professor Whitman deplored the confusion caused by the plethora of seismic design rules and regulations among design professionals who work in more than one jurisdiction. He also said, “Perhaps it is too much to expect that the goal of a unified set of seismic design provisions can be achieved by 1988. At a minimum, however, the organizations involved should agree on a target date—perhaps 1991—for reaching the goal.”

EERI subsequently carried this proposal further at its annual seminar last February, which was focused entirely upon review and comparative analysis of the various codes and standards. EERI is now working to suggest ways to achieve this goal. 

---

### Existing Seismic Equation

$$ V = ZIKCSW $$

- $V =$ the total lateral force or shear at the base
- $Z =$ a numerical coefficient dependent on the seismic zone
- $I =$ the occupancy importance factor
- $K =$ the horizontal force factor
- $C =$ a numerical coefficient based on the fundamental period of the building
- $S =$ a numerical coefficient for site-structure resonance
- $W =$ the total dead load of the building

### Proposed Seismic Equation

$$ V = \frac{ZICW}{R_w} $$

- $V =$ the total lateral force or shear at the base
- $Z =$ a numerical coefficient dependent on seismic zone, quantified differently than the old zone factor
- $I =$ building importance factor (approximately the same as the old)
- $C =$ a numerical coefficient based on the formula: $C = \frac{S}{1+2\frac{P}{I}}$
  (where $S$ is the same as in the old equation, and $I$ is the fundamental period of the structure)
- $R_w =$ a numerical coefficient (from tables) that reflects properties of lateral load resisting systems (similar to $K$ in the old equation, but with a new range of values)
- $W =$ the same as in the old equation
Building disasters make headlines around the world, but fortunately they are rare events. More commonplace than complete collapse are the system and component defects or shortcomings that plague both old and new construction.

Many times these building failures, small or large, cannot be attributed to any single design or construction specialty; the responsibility can be everyone’s or no one’s. The problem can be a design and construction oversight or an inappropriately applied material. It can result years after construction from environmental exposure or from an unanticipated building use. One thing is certain though: failures cost time, money, and often reputations. Avoiding them should be a high priority.

Even as construction begins, environmental exposure is initiating building deterioration. Though building lifespans are finite, buildings should remain intact for an acceptable period of time. How long that period should be is not easy to judge, but it is no longer in vogue to design 15- or 20-year obsolescence into buildings; neither are the overdesigned edifices of past centuries the solution. There must be some middle ground, and one key to achieving it is a better understanding of materials, their properties, and their interactions with other materials as well as with the environment.

A new product marketed without sufficient testing can cause a series of problems unlike those experienced in traditional construction. Even new applications of reliable products can produce unexpected interactions. For example, a new mortar additive, promoted for its ability to effectively glue bricks together, indicated the use of single-wythe masonry construction, an apparent means of reducing materials and labor costs. As with all masonry walls, building codes required steel reinforcement in the single-wythe construction. The system seemed perfect, but the innovative additive contained chlorine, which is extremely corrosive to steel. Add water to the picture and decay is rapidly accelerated. The results were extensive building facade failures and costly litigation.

Ignoring the relationship of one material system with another also can have detrimental effects. Consider the introduction of metal studs into masonry wall systems. The metal studs were intended to take over a market share from concrete block, providing a cheaper and faster means of construction. Manufacturers tested the studs for deflection and found their performance met code requirements.

However, codes do not necessarily reflect the actual performance of the complete wall system. In this instance, the more flexible wall system created by the metal studs caused the masonry veneers to crack and invited greater moisture penetration than ever predicted, corroding metal studs and fasteners. A more thoughtful analysis of component behaviors and systems interaction might have avoided the problem. These systems are still in use, but flexibility is controlled by heavier studs or additional bracing systems.

Combining dissimilar materials causes problems in new and old buildings alike. Lee Nelson, FAIA, chief of preservation assistance for the National Park Service, has seen this time and again in his study of reinforced concrete building structures during the 29 years he has been with the Park Service. Concrete tends to develop tiny hairline cracks that admit moisture that may rust the iron and steel reinforcements. Because rust has more volume than the original steel, internal pressures will build up and cause cracks in the concrete members. The problem is made many times worse in modern buildings where the rebar is typically placed close to the surface of the concrete element.

The rebar is placed less than three inches from the surface, says Nelson, to make it more efficient by increasing the member’s strength. But the building can self-destruct as a result. He thinks such destruction will occur in direct proportion to the proximity of the rebar to the exposed concrete surface. The member may be stronger for a few years, but the closer the rebar is to the surface, the faster it is going to decay. This does not mean that concrete structures should be built without reinforcement—only that the design should consider the behavior of two very distinct materials and components.

Environmental factors affect the rate and extent of material deterioration. Among the most offensive are moisture, thermal...
loads, solar radiation, wind, man-made chemicals, and natural substances such as carbon monoxide and chlorine.

Plastics are particularly vulnerable to rapid deterioration under some environmental conditions. They are damaged not only by light but also by oxidation, hydrolysis in the presence of water, thermal aging, and biological attack. Plastics age most rapidly at high temperatures, but the degree of damage is most severe at the surface and diminishes with depth. The same holds for damage caused by light. Can this type of building material failure be ignored? Maybe. It depends on whether or not the product's function or esthetic value is diminished. Acrylic glazings intended for viewing do not make much sense if solar product's function or esthetic value is diminished. Acrylic failure be ignored? Maybe. It depends on whether or not the substances such as carbon monoxide and chlorine.

A key to predicting design life of new building components is predicting the speed at which environmental factors are likely to impair them. A product's test results should be requested if they are not offered by the manufacturer, and they should be carefully evaluated.

Both old and new materials often succumb to moisture. Failure-resistant design must consider any conceivable source of moisture, including water coming out of the ground due to a high water table or bad drainage; interference with drainage caused by regrading around the building or by landscape design; the natural movement of moisture in and around the building; interior moisture generated by a particular building use, as in a restaurant; and a high level of humidity, as in museums that demand a relative humidity of about 50 percent.

Inappropriate detailing or inferior workmanship, especially in renovation, can exacerbate decay of materials. Repairing deteriorated building components requires care, certainly from the craftsman, but just as surely from the designer specifying the replacement. Substitute materials must be chemically and structurally compatible with the original. Care must be taken to ensure that new materials do not cause decay in existing materials, and the deterioration rate of the substitutes themselves must be evaluated. The task seems immense, but without a lot of up-front design effort that includes extensive materials analysis, a bad problem can get worse. The restoration of the Renwick Gallery of Art in Washington, D.C., provides a classic study of severely degraded masonry materials.

The Renwick Gallery is an early example of French Renaissance architecture in the United States. The shell of the building consists of load-bearing brick masonry with decorative sandstone elements that cover one-quarter of the total facade. The sandstone had suffered serious decay from salts that had leached from interior masonry of relatively soft-fired brick almost continuously since construction was completed. Quite a bit of the stone had broken away and fallen to the street when, in 1968, the Smithsonian Institution, owner of the Renwick, completed a series of repairs, reports a Smithsonian spokesman. By that time it was no longer possible to obtain sandstone from the quarry where the original material had been mined, and none was available that approximated the color. Therefore, the restorers used a synthetic nitrocellulose-based resin mixed with ground sandstone to fill in worn surfaces, molding it to replace missing or damaged sections, and ultimately painting the entire sandstone surface with it. This was a state-of-the-art restoration technique in the late 1960s.

By 1975, large pieces of the restoration were falling to the ground, and the hazard was so great that pedestrians on the sidewalk had to be protected by canopies. The restoration failed for two reasons. First, the sandstone and the resin had vastly different coefficients of expansion. In such disparate materials bonded directly together, daily and seasonal temperature changes created cyclical thermal loads (thermal fatigue) that eventually caused the bonds to fail. Second, the very quality for which the restoration material was specified—it is nonporous and impervious to water vapor—served to make the matter worse. Without further moisture penetration, leaching of salts from intact or bricks would be stymied. But the resin also prevented the sandstone it covered from breathing, thus trapping interior moisture at the interface between the sandstone and the restoration compound. When eventually the resin coating was removed with a fine abrasive, the underlying sandstone was visibly wet despite the fact that there had been no rain for 20 days. The freeze-thaw cycle of trapped subsurface moisture accelerated failure.

The Smithsonian finally decided to replace nearly 90 percent of the sandstone (and all of the original restoration compound) with precast concrete that was chemically compatible with the original stone and could be made to simulate it visually. A special technique developed to attach the precast units is expected to minimize and possibly arrest further decay of the stone. It has been nearly two years since the repairs were completed, and so far there are no more problems.

Problems of detailing are not limited to restorations. Of particular concern to Nelson is the current resurgence of stone-
Normal  

Increase in temperature—Masonry expands  

Decrease in temperature—Masonry contracts  

Flexible lime mortar  

Inflexible portland cement mortar  

Spalling  

Open crack  

Panel building facades. He believes that many stone panels specified today are just too thin. He fears that water will find its way through them to corrode and rust the metal pins that attach the panels to the building frame, causing panels to fall off and shatter.

Additionally, thermal damage may plague these stone facades. A common stone spandrel panel might be six feet long, two feet wide, and only an inch thick. Nelson compares such a unit to the tall, narrow chimneys on 18th-century buildings, which expand and contract daily because of cyclical heat from the sun. Over time, the chimneys developed permanent curves due to this thermal stress. Nelson is convinced that the thin stone panels will respond as the chimneys did.

"Architects need to find a better way to attach these stone panels, and for that matter architectural concrete, to allow for the curvature that will result," he says. "Or else the industry should return to thicker sections so that there is more mass to resist thermal stresses and more material to be anchored."

Problems with building materials and components can too often be traced to noncompliance with instructions. Many new materials look and appear to act like familiar products, but the installation techniques can be very different. Roofing membranes fall into this category, as do caulking compounds. For example, when the new generation of caulking is applied to precast concrete, bond breakers are needed to keep the caulk from bonding to the form. The concrete must be cleaned and neutralized or the strength of the caulk bonds will be greatly diminished.

A contractor might not believe, or for that matter even know, that a material being installed is really different from the one it is replacing. John Loss, AIA, professor and director of the Architectural and Engineering Performance Information Center at the University of Maryland, finds this trouble with roofing all the time. "Contractors see that single-ply roofing membranes look like rubber and their inclination is to use familiar methods to put them down," he says. "But these roofing materials are not rubber and they require the special installation techniques determined by the manufacturer."

Adding to the confusion, designers, too, often do not understand the difference, and they supply details and notes from old products that are in conflict with the manufacturers' guidelines for installing the new products.

"I have investigated thousands of roofing failures," says Loss. "Usually there is big money involved, particularly when contents have been damaged. I can say without a doubt that the cause is virtually always improper installation. There are no problems when the manufacturer's recommendations are followed."

Building problems differ markedly today from those of the past in that lighter materials and smaller safety margins make new buildings less forgiving. Yet professional designers are not necessarily trained to anticipate the widening range of problems that could arise in a contemporary building. In school, architects and engineers are taught to judge building components and structures by their strength and stability, and research for many years has been dedicated to these qualities. However, structures fail today for entirely different reasons. Consider parking garages where steel structural elements are corroded by the migration of salt applied to the pavement in bad weather. From a design standpoint, the problem is a lack of serviceability, not a lack of strength.

Simplified theories and rules of thumb are comfortable tools for designing, and they often replace complex measurements and calculations. These practices served the design professions well until recently, but advances in the technology of components and materials have created entirely new conditions. Moreover, new component and building materials, combined with changes in construction and assembly methods that allow faster and cheaper building, also force architects to contend with a smaller margin of allowable error. The basic principles of design have not changed, but the formulas have, says Loss. Yet the industry still designs with formulas from a less demanding era.

There exists a technological gap between design theory and
actual manufacturing techniques and construction procedures, according to structural engineer Lev Zetlin. The structural behavior of a completed building can be quite different from what was assumed in design analysis. "New materials and components usually live up to their promise," says Zetlin. "But the influence of innovation in one material or component cannot always be predicted with conventional design theories."

The standard procedure for designing tall buildings, for example, is based on the assumption that a minimum grade of structural steel will be used, which in turn will produce a structure able to support a specified number of pounds per square inch. With standard steel members under a conventional approach, noticeable building vibration and noise transmission do not occur and thus are not design issues. Advances in technology have produced steels of greater strengths, however, making it possible to reduce the amount of steel in building structures. The lightweight steel does live up to its promise: it provides greater economy and function, Zetlin says. The trouble lies not with the material but with its application. Unfortunately, designers have been using the same formulas for buildings with lightweight steel frames as those they depend on for heavier structures. Unlike their heavier counterparts, lightweight steel structures are subject to vibrations and deformation of columns and beams that can significantly affect their behavior. The result is building failure in the form of broken window frames and glass, cracked walls, and excessive sound transmission.

Fatigue and fracture have become major concerns. Cyclical loading is contrary to almost everything building designers have learned in the past. A static load of a given magnitude responds one way; the problem becomes quite different when the load has several million cycles. The characteristic loading and unloading of fatigue—caused by thermal load, wind, or occupants—normally is not accounted for in building design. Welding of building structures began about 20 years ago, and the static strength of welds was anticipated by translating design criteria. It was not recognized that welding caused a notch condition extremely sensitive to even minor loads, which produced cracks that could propagate thermally after numerous cycles.

A constant pressure to stretch components to closer tolerances is presented by tight schedules and budgets. With every advance in technology, more building limits are tested. Our technological capabilities are reflected in the capacity to generate closer tolerances, says Loss. Throughout construction history, the plus and minus factors have been getting more precise, more accurate. There is no problem building steel structures within one-sixteenth of an inch of design specifications, or precast concrete structures within one-eighth inch.

"I have a problem when you start slicing our safety factors, though," Loss says. "Designing with zero redundancy in critical structures is just bad practice. Unfortunately, economy drives these things. It is cheaper to do away with redundant supports, but we should not have it this way." No redundancy means no backup system, so even a little problem can result in disaster.

Zetlin agrees. As things become more commonplace, they get built more conservatively, he says. Redundant elements, by definition, are not necessary to support a structure under normal conditions. However, redundant elements are more likely to pick up a load should a critical member fail. Under these circumstances, a load redistributed to a redundant member might cause signs of distress, such as sagging or vibration. With adequate redundancy, the structure will not fall down and the problem may be corrected before disaster occurs.

It is common, Zetlin says, for engineers and architects to assume that the secondary stresses always present in structures will be small and that a safety factor can accommodate all unanticipated stresses. A design might correspond exactly to standard practice, but minor deviations during construction or, over the life of the structure, actual loads, traffic, and weather patterns that differ only modestly from the assumed sequence can easily transform the conventional into the unconventional. The causes of failures seldom are major mistakes. They generally are minor deviations that cause extraordinary stress.
Natural beauty, durability and stability make it the natural choice for creative designs that endure. Send for Redwood Architectural Guide.
CADD on the Cheap Using PCs

Surveys show it growing in favor.
By Elizabeth J. Macklin, AIA

Only two years ago, some firms were buying minicomputer-driven systems for as much as a half million dollars while their equally forward-thinking but less capital-committed colleagues were settling for the limited capabilities of micro personal computers.

The market has since taken a radical swing toward a new generation of personal-computer CADD workstations. The increasingly available hybrid machines are able to run software that delivers the computer-aided design capabilities of older minis, but at costs of less than $50,000. The result, judging from AIA's 1987 survey of architecture firms and a less formal survey of major CADD vendors, is a move by buyers and manufacturers alike away from multiple-user, large CADD systems to powerful new 32-bit personal computers and accompanying software.

At the heart of this shift is the 32-bit processor, which since 1980 has moved from installation in large, expensive machines to use in desktop systems. The significance of this development can be better appreciated with a little historic perspective. During the '70s, most home personal computers were intended for educational and entertainment programs like Reader Rabbit and Donkey Kong. These were 64K personal computers: they could hold 64,000 bytes for immediate random access. (A byte equals eight individual binary digits, or bits. A bit is the fundamental form of all computer information.) The set of master switches that controls information flow—the microprocessor—could pass eight binary digits through at a time; thus it was known as the eight-bit microprocessor. Though it was useful in the home, this very early machine had no business applications to speak of.

The personal computer proved its worth as a business tool in the '80s. Popular word-processing and spread-sheet software now runs on personal computers that typically have 640K bytes of random access memory—10 times that of the early home models—and often runs twice as fast on 16-bit microprocessors. An equally dramatic increase in computing power came with 32-bit computers that can hold 1.2 million bytes and more. And just as the earlier leap in technology took personal computers from toys to business machines, this leap to 32-bit capability is pushing the personal computer into the more complex arenas of architectural and engineering design and analysis.

While advancements were being made in hardware, CADD software was not far behind. Ten years ago, high-cost CADD was the only CADD available to architects. At several hundred thousand dollars per system, the expense for hardware was only the beginning. To house these machines, firms built specially airconditioned and soundproofed rooms. To use available soft-
cessors. Intergraph sells a new low-priced station that can tie into a network with other architectural workstations and powerful VAX minicomputers, all running Intergraph's software.

Likewise, vendors who started out with products for the older generation of personal computers are now creating products with more advanced features. Developers of Versacad, Autocad, Pointline, Datascad, and Space Edit all claim 3D capabilities. A number of these and other vendors offer solids modeling, animation (allowing visual "walk through" of spaces), and the ability to work with photographic images captured on video.

Features for working with written descriptions of materials and spaces vary from product to product. Some have built-in programs for organizing nongraphic data and linking it to drawings. Others provide links to off-the-shelf data base management software such as Ashton Tate's dBase series.

Vendors that are serious about selling to architects now emphasize how their products are tailored specifically to architects' needs. Companies either start with architecture as the primary application for their drawing packages, as did Microtecture, or they offer special modules for architects, as do Autodesk, Intergraph, Micro CAD/CAM, Sigma, and T&W Systems.

Because architects are contributing to software development in a number of different ways, vendors will be creating a variety of new design tools. Most companies have groups of architectural users who meet regularly to comment on software performance and suggest improvements. Some companies, such as McDonnell Douglas and Intergraph, have architects who manage the development of their architectural product lines. Other companies, notably Autodesk, Micro CAD/CAM, and T&W Systems, encourage users to develop libraries of symbols and procedures that can be sold as supplements to their products.

Despite the variety of big-CADD and small-CADD vendors pursuing the same market, vendors have yet to offer the perfect product. So far, few programs for architects follow an easily grasped intuitive process. Furthermore, improvements in hardware technology come out so rapidly that software writers sometimes have a hard time keeping up.

For the new purchaser, system selection remains a process of knowing a firm's needs and making the appropriate compromises. The rule is: know what you can live with, as well as what you would rather live without. Software that is easy to use often has been limited to small data bases or has offered few opportunities for customizing for special applications. Fast, high-quality output is available only with expensive plotters and printers.

Approaches to training, once the greatest stumbling block in using a new system, are beginning to reflect a demand for "friendly" software. Traditionally, large-system vendors offered two weeks of training to purchasers of new systems. Subsequently, architects could expect to take as long as six months to become proficient. As time passed, more choices in what to spend and whom to consult became available. With low-cost CADD, authorized training centers and microcomputer dealers offered instruction at fees of $500 and more for three to five days of classes.

Vendors now supply manuals with tutorials for beginners, and software is written with features to help remind architects of command choices.

Problems of translation between software programs and compatibility of hardware are examples of the issues architects must consider when they want to improve their systems, and assembling hardware with the new systems is as difficult as ever. Equipment configurations are still unintelligible to the uninstructed. Monitors (video displays that look like TV sets) must be compatible with graphics cards (circuit boards controlling the monitors), which must be compatible with the main computer processor. The problem is complicated by frequent changes in equipment specifications. And limitations in systems are not always obvious.

Firms selecting systems for the first time need to think ahead. Sidestepping technical limitations means asking a lot of questions. Vendors offer these suggestions:

- It is often a good idea to work with a consultant, but if you do, make sure that someone on your staff understands the logic behind each decision or action throughout system selection and installation. Learn enough to be able to fix the problems that may occur when your consultant is on vacation.
- Ask vendors and dealers how their products allow users to add new capabilities after purchase.
- Ask software vendors for the price and timing of major improvements. Even if they can only tell you when they offered past improvements, you get an idea of how often new versions are released.
- Buy standard hardware. Ask dealers who propose to sell you a computer they claim is compatible to define "compatible." All computers differ from each other in some way.
- Consider computers with "open architecture," a feature that allows more possibilities for system development through products by third parties.
- Know the name of the computer's operating system—the software that controls and schedules the way the computer runs other software—and confirm that vendors will support their CADD software under that system.
- Be aware of which graphics cards, printers, plotters, and other products will work with your computer or CADD software, so you can begin to identify options for improvement.

While easy-to-use products prompt fewer questions about system problems, technical assistance is always important. People who enjoy using CADD will stretch it to its limits. Architects need to know that technical support is available for just such situations. Dealers and consultants have long been a source of such support. CADD manufacturers also offer telephone technical services, usually at a charge. Autodesk, which produces the most commonly used CADD software, sponsors a forum for users on an electronic telephone conference service.

Most experts advise architects to create a plan to grow into CADD. Expect change, says architect and computer consultant Nick Weingarten, AIA. "Look at what you are trying to do and what it is worth to you. Then buy a tool that people can learn to use. As people become skilled, upgrade."

In assessing today's market, Douglas Stoker, a partner in Skidmore, Owings & Merrill's Chicago office, recommends, "Whatever you spend, look for software that runs on generic hardware that is easy to maintain. The most versatile software runs in full 3D and allows easily definable links between graphic and nongraphic data."

Firms facing a purchase this year will do well to consider it as a first step rather than a final one. In the next few years there will be significant changes in products and in architects' abilities to use them.

All projections and analyses of the survey of AIA member-owned firms in this article are our own, drawn from raw data made available to Architecture. The published results from AIA were not available to us by press time.
Presenting
MASTER SYSTEMS

New software programs designed to expand your client base and increase your bottom line.

Our MASTER SYSTEMS name may be new, but you're already familiar with our quality products like MASTERSPEC®, the master specifying system for microcomputers.

Last fall we introduced FM:FORECAST™, a space forecasting tool for microcomputers, and now we're broadening our service by offering you a wide variety of software tools called MASTER SYSTEMS.

Take a look at these three new programs designed to help you extend your services, boost your profits, and make the most of your investment in computer hardware:

RFP™
Marketing software designed to help you win more projects by writing targeted proposals, both public and private.

ENERGY:DESIGNER™
It's a requirement in many states now, and with this easy-to-use software, even without in-depth technical knowledge you can simulate the energy demands and costs of a building during the design stage.

REAL ESTATE MASTER™
Software that gives you the information you need to advise clients on the potential profitability of a building, even before it's designed!

You can count on MASTER SYSTEMS to be one step ahead in identifying your professional needs and helping you meet them. So, examine the AIA's MASTER SYSTEMS software programs—you'll find new software developed especially for you, the design professional.

For more information about the MASTER SYSTEMS concept or any of the MASTER SYSTEMS software packages, just call us toll-free at 800/424-5080 or write:

The American Institute of Architects Professional Systems Division Marketing
1735 New York Avenue, NW
Washington, D.C. 20006

MASTER SYSTEMS—Software Programs for Today's Design Professional
It is no secret that steel and steel alloys are susceptible to corrosion when exposed to oxygen, moisture, certain chemicals, and other metals. And that the most effective protection against steel corrosion is the application of a protective coating. The principle is simple enough, but actual specification of a steel-protective coating must take into account the exposures the steel must endure; the chemical interrelationship between the grade of steel used, primer, and top coat; the finished appearance the architect desires; and the proposed maintenance schedule.

Anticorrosion coatings for steel include metallic coatings, such as hot-dipped zinc; inorganic coatings, such as vitreous enamels; and organic paint and paint-like coatings. This discussion will concentrate on organic paint and similar coatings: those generally defined as coatings consisting of a mixture of insoluble particles of pigment suspended in a continuous vehicle that is either organic or aqueous.

The criteria for selection are:
• Alloy compatibility. When selecting a paint-like coating, be sure to consider the type of steel alloy to which the coating will be applied, because some coatings are better suited than others to certain steel alloys. Water reaching the metal surface dissolves a certain amount of the pigment in the coating, supplying the necessary concentration of inhibiting ions: to reduce corrosion potential. For instance, zinc-rich paints cathodically protect the steel, in essentially the same way hot-dipped zinc coatings do. Likewise, when water reaches a steel surface coated with a red lead paint, the paint releases a sufficient amount of inhibiting ions to passivate and protect the steel.

• Job size. The selected coating must match the size of the job. For instance, a brushed-on coating probably takes too long to apply to a multistory steel frame structure.

• Solvent toxicity. It's wise to check the solvent emission level of some coatings, since they can be extremely hazardous; and of course make sure the coating complies with fire ratings.

• Maintenance. Acrylics, vinyls, and other single-component coatings, generally termed thermoplastics, can be refurbished once the surface is cleaned and bare, or rusted areas are touched up with a primer. Multicomponent coatings, such as epoxies, need a clean, dry surface that has been abraded to produce a profile. This will require a higher level of skill and attention by the maintenance workers.

• Color. Cost and color may be the first and last considerations, depending on budget and where the coating is going to be applied. Epoxies are excellent for corrosion protection, but they tend to fade and chalk on exterior applications or in aggressive environments. Where gloss and color retention are necessary, catalyzed aliphatic urethane may be the best choice. However, under normal weathering conditions and with a limited budget, good alkyd or acrylic emulsion coatings will do nicely. A coating that requires special environmental conditions isn't recommended if the coating is to be site-applied.

• Surface preparation. For a coating to prevent corrosion, it must be applied on a properly prepared surface according to the manufacturer's instructions. Adhesion and bonding are the two means by which a coating attaches to the steel substrate. Adhesion is a molecular attraction of the interfacial forces of both the coating and the steel substrate. Bonding is the mechanical attachment between the coating and the substrate. Both adhesion and bonding must occur for a coating to be effective.

Methods and their resulting degrees of surface preparation vary greatly. Before any one method is specified the architect should consider first the environment to which the steel will be exposed. Coastal and dense urban environments are more corrosive than inland and rural environments. Secondly, the architect should consider the expected service life of the coating. Some coatings are less tolerant than others of surface contaminants and require extremely clean substrates with good surface profiles to achieve proper bonding. Zinc-rich coatings and vinyl coatings are particularly intolerant of contaminated substrates.

The surface preparation requirements often are dictated by the type of coating specified, as well as the type of steel, and can incorporate a number of methods and materials. Solvent cleaning, for instance,
is particularly important in removing surface grease or oil prior to abrasive cleaning, which by itself is ineffective in removing oil and grease. Specification of a coating must include text dealing with surface preparation. The text should clearly specify that all forms of surface contamination be eliminated, that the size and hardness of the abrasive be selected according to the type of steel, and that all abrasive residue be removed from the work area prior to coating. Also, consult with the coating manufacturer to set abrasive blast or solvent cleaning standards. Before the cleaning work begins, require the contractor to clean a sample test area for your approval to set the standard for the work. In addition, all weld splatter and slivers should be removed and the coating applied before flash rusting can occur, usually within 24 hours.

For applications that require abrasive cleaning, the Steel Structures Painting Council (SSPC) and the American Socio-

Primers
tive blast or solvent cleaning standards. Before the cleaning work begins, require the contractor to clean a sample test area for your approval to set the standard for the work. In addition, all weld splatter and slivers should be removed and the coating applied before flash rusting can occur, usually within 24 hours.

For applications that require abrasive cleaning, the Steel Structures Painting Council (SSPC) and the American Society for Testing and Materials (ASTM), along with several other organizations, have published a pictorial reference book that sets abrasive blast standards.

**Primers**

Many coatings require a primer before application, and the primer must be compatible with both the steel substrate and the topcoat. If the primer doesn't adhere and bond properly to the steel, off it will come, taking the topcoat with it. Likewise, the topcoat won't last long if it doesn't bond with the primer. Most manufacturers state clearly which primers to use with which coatings. The primer is often the component that carries the rust-inhibitive pigment, while the topcoat provides a protective surface.

Zinc chromate is a low-cost, rust-inhibitive primer pigment, considered not as toxic as red lead but still unacceptable in food processing areas. A whole family of zinc chromate primers is manufactured for specific applications. Zinc-rich primers (not to be confused with zinc chromate primers) contain 80 percent to 95 percent zinc dust by weight of the dry coating. Their major drawback is that they are considered difficult to apply.

Where a white primer is called for, an oxide white primer is often the answer.

Where a steel surface needs protection from a highly corrosive environment, or where immersion in water is expected, epoxy primers are recommended. Some epoxies have a limited color range and many have a short pot life once mixed. Alkyd primers are often called universal because they accept most topcoatings, but they do have limitations. They tend to lift when they come in contact with vinyls, epoxies, chlorinated rubber, or urethane coatings.

Several primers don't use rust-inhibitive pigments to protect the steel because they are themselves so water-impervious that the essential electrolyte can't reach the steel and rust can't occur. Vinyks are among these water-impervious primers; however, one must be cautious when specifying a vinyl primer. It will require excellent surface preparation to achieve adhesion, and the use of a pretreatment primer is recommended. Red oxide, another primer that excludes moisture from the steel but has no prohibitive properties to speak of, has been around for a number of years and is still used extensively.

Aluminum primers with aluminum as the sole pigment have no inherent rust-inhibitive properties. Zinc chromate or strontium chromate is added as a rust inhibitor. As with all the other primers, aluminum primers come in a number of formulations, and the architect should consult the manufacturer to match the proper primer with the job's special conditions.

**Curing**

The mechanisms by which protective coatings cure are another important consideration. Each mechanism is greatly influenced by the type of resin present. The four common mechanisms that promote curing are solvent evaporation, oxidation and polymerization, cross linking, and hydrolysis.

Solvent evaporation mechanisms rely on the resin molecules' natural attraction for one another, resulting in an ever-tightening film. The final product is a solid, continuous coating. Coal tar pitch solutions and chlorinated rubbers and vulcanics are examples of coatings cured by solvent evaporation.

Oxidation and polymerization mechanisms rely on molecules of the same type combining (polymerizing) in the presence of oxygen to form the required solid film. Epoxy esters, vegetable oil-type paints, and oil-modified alkyds are all classified as oxidation and polymerization coatings.

Cross link mechanisms, unlike oxidation and polymerization mechanisms, work when dissimilar molecules without oxygen combine to form the required coating. Polyester epoxies, catalyzed epoxies, coal tar epoxies, urethanes, and zinc-rich epoxies are all coatings that cure using a cross-link mechanism.

Hydrolysis mechanisms depend on the reaction between the resin and the moisture in the air (as opposed to the air itself) to cure the coating. An example is an alkyl silicate inorganic zinc-rich coating.

**Already corroded walls**

If there is an existing coating on the steel surface, make sure it is compatible with the new coating, and require that it be properly prepared before the new coating is applied. If the surface is already rusted and corroded, consider specifying one of the coatings developed specifically for application over rust. These coatings are meant for situations where proper surface cleaning isn't possible or for areas of limited space or intricate surfaces. The high-build polyamide epoxy coatings go on over the rust with little surface preparation (only removal of flaking rust in most cases) and provide a moisture and chemical barrier that retards or prevents further corrosion.

Other coatings actually react with the corrosion products, turning them into a passive insoluble organometallic compound as hard as the original steel. (Of course, the architect shouldn't confuse hardness with structural strength.) These chemical formulations consist of tannin derivatives and phosphoric acid combined with an appropriate wetting agent. When brushed, sprayed, or rolled on a rusted metal surface, they convert the unstable iron oxides into stable ferric tannate. However, not all these products are equally effective, according to Martin Weaver, of Heritage Canada Foundation. He states in the Association for Preservation Technology Bulletin (No. 1, 1987): "In order for the passivation or corrosion-product conversion process to be completed, oxygen must continue to reach the surface. Resin and solvent-based 'converters' tend to form a skin, excluding oxygen and preventing completion of the conversion."

Water-based products are more effective because they penetrate rust better than resin-based products. In addition, resin-based products can't be used on heavy, wet, or soluble rust. There is little available information on the long-term protection these coatings provide.

—Timothy B. McDonald
What can you do with a 13,732-square-foot showroom in four weeks for $30,000? That was the problem posed to SITE, the firm hired to do Allsteel Corporation's permanent showroom at the International Design Center (IDCNY) in Long Island City, N.Y.

Employees had bought out the company, and the new management faced the prospect of an empty showroom at the industry's big fall event in New York City, "Designer's Saturday," just when they wanted to dramatize the company's move away from its staid, conservative image.

To emphasize Allsteel's history—75 years of marketing a complete line of office equipment—as well as its new products, SITE came up with the concept of an archeological display—the "big dig," in the words of project architect James Wines. All the products included were made by Allsteel; some of the older ones were bartered away with difficulty from their original owners in exchange for newer equipment. The older products were grouped together and covered with spray glue and many layers of sand and were set in the center of the vacant showroom. This assemblage served as base and background for the company's new products, left uncovered.

The display drew crowds, more than anticipated. It also provided amusement for the IDCNY employees, who brought their friends in for a viewing. Allsteel (whose creative people remember no small amount of trepidation when showing the SITE concept to management) decided to make the temporary display permanent and installed it behind glass in the lobby of its headquarters outside Chicago.

—SHARON LEE RYDER

ARCHITECTURE/JULY 1987 105
If modernist architects had their way, no one would be surprised to see the world redesigned with straight edges, down-lighting, geometric hills, and gridded ground planes on which all the pieces might rest—a carefully ordered environment with not one irrational curve nor one object out of place. While a mere 3,728 square feet doesn't constitute the world, architect Stanley Felderman did adapt such a metaphorical landscape for the design of the Gunlocke furniture showroom in Dallas's World Trade Center, showing just what it is possible to do when architects confront the natural order of things.

Felderman chose the landscape imagery as a way of expressing the idea of evolution and change, both in the design of a series of showrooms for the Gunlocke Co. (of which this was the fourth and last) and in the company's shift from a conservative, dealer-oriented firm to one perceived by the specifier as very design-conscious.

With the purchase of the company in 1981 by some of its officers, the new, younger management team wanted the 80-year-old furniture company to make its mark by evolving products that would combine the quality implied by longevity with the appearance associated with being at the leading edge. Their original concept included both the introduction of new products and the design of showrooms to reinforce their image.

Working within the constraints of an existing building, a compressed schedule, and a tight budget, Felderman picked up elements he had used in previous show-
The change in floor material and height at the entrance breaks up an undefined space into smaller display areas for the company's product.

Room designs and developed these ideas further, to show visual progression from one to another. The white triangular plane floating below the black ceiling and the dark gray carpeted platforms are all aspects of an abstract landscape, representing clouds and hills. More literal is the fissure, an organically shaped form in granite with an inlaid grid of black plastic set into a warm lavender-gray carpet. The collision of shapes appears as if the ground has been peeled away, revealing what lies beneath. Located at the entrance to the showroom, this large fissure draws people into the space, guiding them past two small display areas.

A second fissure, reduced in scale, penetrates a cube at the rear of the showroom, wrenching apart the walls and creating an entrance into a semiprivate conference and audiovisual facility. The visual irony here, not easily discernible, is the distorted size of the open portion of the cube; the corner will, in fact, never fit back into place to close the cube. Other subtleties are present in the way the grid of openings in the walls changes the proportions of solid to void in the enclosure, rendering the cube nearly transparent at one end, almost a fortress at the other.

Although the landscape metaphors were the prime generator of forms in the showroom, the main focus of the
At the far end of the showroom, the volume of the enclosed conference room is pierced by a granite fissure similar to the one at the entrance. Windows that grow larger lend a sense of transparency at the entrance to the conference room.

space is this cube, which appears wholly man-made, its strong geometric forms pierced by the cleft. The natural versus man-made is just one dichotomy built into the design. The other is the balance between making a strong design statement, capable of influencing specifiers’ perceptions of the company, and allowing the furniture its prominence as the major product. Outside the conference room, no specific uses were assigned to other areas, and no particular type of display system was developed. This left Gunlocke free to display its products in whatever manner seemed appropriate and to accommodate new product introductions without redesigning the showroom. The simple, raised platforms break up the space, providing focal points for older products to be seen in their new setting. Felderman also had the opportunity to select the wood, metal, and fabric finishes for all the products that were to go into the showroom, thereby gaining a greater degree of coordination between container and product than is usually possible.

Although the change in Gunlocke’s image came gradually over the course of four showroom designs, Felderman remembers that at the outset what he considered restrained was a radical departure for Gunlocke, and it changed their thinking around. By the time the fourth showroom was completed, the company had realized a total transformation of image as well as a change in attitude about design. Felderman’s satisfaction is in taking his client along and watching this process of change.—Sharon Lee Ryder
With personal computers becoming ever more powerful and affordable, there's never been a better time to look into the benefits of doing your design work on one.

At Autodesk, we've put together a few guidelines to help make shopping for a system a little easier.

**Draw Up a Plan.**

First, consider the software. You don't want to spend months learning it (you've already spent enough time learning your profession). And you don't want to shell out a bundle, either.

Consider AutoCAD AEC®. The name stands for architecture, engineering, and construction, and it works in tandem with our industry-leading AutoCAD® package. Which itself has introduced computerized drafting to over 90,000 people.

Put AutoCAD AEC on your choice of more than 30 popular microcomputers, and you can set up an entire system that's well within your budget.

**One-Stop Shopping.**

Next, consider a system that gives you all the features that are important to your work. Starting with accuracy and speed.

With AEC, distances are dimensioned, and schedules generated, automatically.

Routine drafting is faster. Even the process of transmitting plans is speeded up, reducing overall project time.

Customization is important, too. So AEC makes it easy for you to create your own specialized symbols.

All of which results in less time spent on drudgery, and more time trying out new ideas.

Which, after all, is what good design is all about.

**The Value of a Name.**

There's a lot to be said for going with the leader in the field.

Like the comfort of knowing that nearly two out of three of your colleagues doing microcomputer AEC applications are using AutoCAD products

Or the confidence of knowing that most major architecture schools are teaching AutoCAD.

Or the security of knowing that with 90 authorized AutoCAD training centers across the country, there's sure to be one near you.

Want to see how AutoCAD AEC can help you? For a demonstration, just see your nearest AutoCAD dealer. Or call or write for the name of one in your area.

And see how easy shopping for CAD can be.
When Houses Could Be Ordered from the Sears Catalog

ENOUGH HOUSES HAVE BEEN BUILT ACCORDING TO OUR PLANS AND WITH OUR MATERIALS TO SHELTER A CITY OF 40,000 PEOPLE

When you purchase a house from Sears, Roebuck and Co., WE GUARANTEE every Modern Home in our Catalog to be lithographed and to arrive perfect at your home. You take no risk. We guarantee, to furnish sufficient materials to complete the house you purchase. We guarantee that the implement when examined does not expect to be in every trade, but will be shipped back at your expense. Katherine Cole Stevenson and H. Ward Jandl, eds. (Preservation Press, $24.95.)

This book has been in the making for some time, and it is a welcome addition to the growing literature on industrial vernacular architecture. This kind of vernacular represents the overwhelming majority of building in this country, and the system that produced structural and finish goods for Sears also produced churches, stores, warehouses, and light industry buildings for the rest of the country.

The book has two sections. The first begins with testimonials about the value of Sears houses and a brief essay on Sears's design, production, sales, and distribution systems. The second and larger portion reproduces specific pages from Sears catalogs, sorted into design types, and concludes with a brief bibliography and two indexes: styles (trade names) and catalog numbers for cross-referencing.

Sears sold pre-cut houses from 1908 to 1940, producing about 15 houses in two grades—Honor Built (top quality) and Standard Built. The typical Sears house was a frame building with an easily recognized shape, with cladding materials and finishes that allowed the house to be absorbed into the general population of housing stock. In terms of design, Sears reflects safe, middle-class ideas about single-family housing within modest square footage.

The authors of Houses by Mail have attempted to sort housing types by a few essential elements: roof type, entrance placement, number of stories, and dormers. While I would prefer more analysis of the material to clarify Sears's role in the history of design, this book was conceived of as a primer. It is intended to motivate people to detect Sears buildings, and whether or not that activity produces a great inventory, it should enlarge the data base for this kind of vernacular. That could be significant, because this architecture, which is original to the U.S., is the least understood. If only some people identify Sears houses, and if the promotional activity for this book by the National Trust for Historic Preservation is successful, more people will learn something about the nature of their built environment, and that is a good thing.

—HERBERT GOTTFRIED

Dr. Gottfried teaches architecture at the college of design at Iowa State University.

Books continued on page 112

ARCHITECTURE/JULY 1987 111
The title reflects a quasi-psychoanalytic undercurrent that runs through the text, surfacing at moments when the author claims to have penetrated “the deepest level of content in the buildings under consideration.” Like the Freudian psychoanalyst, the author is interested in the “figure in the shadows,” which is the figure of the self. At the end of the book, this figure stands in what the author calls “the secret city” with no place to hide, fully revealed as “ourselves,” the subject of the author’s storytelling.

Freud, unlike Gavin Macrae-Gibson, understood that “content” is an inexhaustible fabrication of the interpreters—patient and analyst. And Freud might also have said that the determination of a “deep layer of content” is especially tricky because the “method of repression tends to obscure the relation between layers of consciousness. In any case, Macrae-Gibson stops far short of the implications of the psychoanalytic model. He uses Freud (and others such as Ronald Barthes and Claude Lévi-Strauss) to validate a position that others such as Ronald Barthes and Claude Lévi-Strauss) to validate a position that he finds in the Portland building, the “critique of monumentality” that he finds in the Gehry house, the “critique of monumentality” that he finds in the Portland building, and so on, are extremely important observations. They are not, however, one observation among many, as Macrae-Gibson seems to treat them.

If anything of importance has come out of recent critical theory, it is that critiques of centrality throw everything else—historical argumentation, impressionism, imagery, and metaphor—into jeopardy. These can no longer be pursued without a good deal of irony.

I have said very little about the other projects that Macrae-Gibson writes about, taking the Gehry house as a paradigm for his general inquiry. However, he does write extensively and often with more force about the other projects. And the conclusion of the book, with its reinsertion of the reader into the “city as a machine for thinking in,” is a compelling concluding gesture. But the book as a whole is incomplete. It is as if the author went through a partial divestiture of conceptual baggage and stopped suddenly, inexplicably, in the middle of the process. And then turned back.

—CATHERINE TOLIN INGRAHAM

Dr Ingraham is special projects director for Betrand Goldberg Associates in Chicago.

The New Atrium. Michael J. Bednar, AIA, (McGraw-Hill, $37.50.)

This book delivers most of what it promises. “The intention,” says Michael J. Bednar, AIA, “is to analyze a prevalent, architectural phenomenon, to reveal design principles, and to give technical aid to practicing architects and engineers.” The

Frank Gehry's own house in Santa Monica, Calif., winner of a 1980 AIA honor award.
increasing prevalence of the latter-day atrium is undeniable. As Bednar points out, an atrium building has won a national AIA honor award in 18 out of the last 25 years.

But the atrium is an ancient design phenomenon. Thus the book begins appropriately by tracing the historical development of the atrium building type. Mesopotamian, Greek, and Roman houses lead eventually to Renaissance palazzos. Having defined an atrium as “a centroidal, interior, daylight space which organizes a building,” Bednar further delimits its meaning in the 19th and 20th centuries, saying that the “new atrium” must be roofed. This clearly distinguishes it from ancient prototypes, with open courtyards, cortiles, or galleries. Accordingly, Sir Charles Barry’s Reform Club in London, built in 1841 and modeled after the Palazzo Farnese, is cited as the first new atrium architectural precedent. It had a light-admitting, vaulted roof of metal and glass over its interior court.

Bednar divides the 19th and 20th centuries into three atrium “epochs”—the first, iron and glass in the early to mid-1800s; the second, turn-of-the-century; and the third, the last 20 years. Among “second epoch” examples cited are the Pension Building (1887) in Washington, D.C., Denver’s Brown Palace (1892), and Frank Lloyd Wright’s Larkin Building in Buffalo (1904). Forty-seven “third epoch” projects are presented as design studies in part two. They are grouped by building type—office, institutional, and civic, housing and hotels, and retail and mixed use. Each set of building types, in turn, is organized by atrium type—closed, open, linear, multiple lateral, and partial. Many of the projects will be familiar to most readers: Hyatt Hotels pioneered by John Portman; New York City’s Trump Tower, Citicorp Center, and Ford Foundation building; and the National Gallery of Art east building, Intelsat, and the Old Post Office in Washington, D.C. Chapters in part one refer periodically to projects described in part two, each of which includes its own analysis and commentary, along with photos, plans, and sections.

There is a chapter on urban design in part one that discusses atrium spaces within city fabrics as places of destination, orientation, passage and connection, commerce, and recreation. It points out how atria can be mediating spatial junctions between old and new, facilitators of historic preservation. A section on design analysis attempts to define atrium spatial and programmatic types and considerers (always favorably) the economics of atrium buildings in comparison with conventional building types. Incontrovertible design guidelines, such as “make the design respond to the context” and “use furnishings to enhance the space,” conclude this chapter. The last two chapters, on energy and detailed design, qualitatively address the context and use fur-

Atrium types are grouped by building type—office, institutional, and civic, housing and hotels, and retail and mixed use. Each set of building types, in turn, is organized by atrium type—closed, open, linear, multiple lateral, and partial. Many of the projects will be familiar to most readers: Hyatt Hotels pioneered by John Portman; New York City’s Trump Tower, Citicorp Center, and Ford Foundation building; and the National Gallery of Art east building, Intelsat, and the Old Post Office in Washington, D.C. Chapters in part one refer periodically to projects described in part two, each of which includes its own analysis and commentary, along with photos, plans, and sections.

There is a chapter on urban design in part one that discusses atrium spaces within city fabrics as places of destination, orientation, passage and connection, commerce, and recreation. It points out how atria can be mediating spatial junctions between old and new, facilitators of historic preservation. A section on design analysis attempts to define atrium spatial and programmatic types and considerers (always favorably) the economics of atrium buildings in comparison with conventional building types. Incontrovertible design guidelines, such as “make the design respond to the context” and “use furnishings to enhance the space,” conclude this chapter. The last two chapters, on energy and detailed design, qualitatively address the context and use fur-

Atrium types are grouped by building type—office, institutional, and civic, housing and hotels, and retail and mixed use. Each set of building types, in turn, is organized by atrium type—closed, open, linear, multiple lateral, and partial. Many of the projects will be familiar to most readers: Hyatt Hotels pioneered by John Portman; New York City’s Trump Tower, Citicorp Center, and Ford Foundation building; and the National Gallery of Art east building, Intelsat, and the Old Post Office in Washington, D.C. Chapters in part one refer periodically to projects described in part two, each of which includes its own analysis and commentary, along with photos, plans, and sections.

There is a chapter on urban design in part one that discusses atrium spaces within city fabrics as places of destination, orientation, passage and connection, commerce, and recreation. It points out how atria can be mediating spatial junctions between old and new, facilitators of historic preservation. A section on design analysis attempts to define atrium spatial and programmatic types and considerers (always favorably) the economics of atrium buildings in comparison with conventional building types. Incontrovertible design guidelines, such as “make the design respond to the context” and “use furnishings to enhance the space,” conclude this chapter. The last two chapters, on energy and detailed design, qualitatively address the context and use fur-
Announcing the new Fry Reglet Plaster Control Screed (2-Pc)—a two-piece extruded aluminum plaster molding that is both functional and pleasing to the eye.

The Fry Reglet Plaster Control Screed (2-Pc) provides these unique benefits:

- **A functional movement joint**: The molding allows plaster to move more freely, to relieve stress and cracking.
- **Design enhancing feature strip**: Accentuates or creates exterior design lines.
- **Color complement or contrast**: The Plaster Control Screed (2-Pc) can be painted or anodized to complement or contrast with stucco finish.
- **Styrofoam spacers**: Moldings are supplied with styrofoam spacers to facilitate alignment during installation, and are installed as a single unit, thus reducing "on the job" labor.

The Plaster Control Screed (2-Pc) features:

- **Durable two-piece molding** made from extruded aluminum.
- **Reveal and ground dimensions** compatible with standard Fry Reglet plaster moldings.
- **Variety of stock finishes** including clear or color anodized, stock or custom paints, chemical conversion coating.

Fry's new Plaster Control Screed (2-Pc) adds functional beauty to your Design.

So get plenty of rest, drink lots of fluids and call Fry in the morning.
Coming: Concrete Block with Biaxial, Horizontal Openings

A new manufacturing process for concrete masonry units (CMU) developed by the National Concrete Masonry Association (NCMA) promises to revolutionize the CMU market.

A block with biaxial, horizontal openings should be generally available by the end of 1987. Biaxial (Bi-X) block creates a network of vertical and horizontal cavities within walls, resolving the problem of utility integration inherent in typical hollow-unit masonry. Modular grids of access created by the biaxial openings allow integration of electrical power, data communications wiring, plumbing, acoustical inserts, thermal ventilation, and more.

In the case of electrical integration, the block can be used like a utility course. A closed-cell rubber or flexible PVC wire trough with a lengthwise slit at the top accommodates the wiring.

Multiuse inserts fit into Bi-X block openings to hold partitions or wall-mounted objects. Multiuse inserts can also be used for electrical, plumbing, hardware, or general access cover plates. Steel rods placed within the wall provide additional support for wall-mounted elements, if necessary.

All Bi-X block courses can be accessed on every floor, so the integrally insulated block can be used to distribute air vertically and horizontally. For instance, by connecting a roof cavity to parapet-wall vents, the Bi-X block collects hot air and distributes it through the cores to the outside. Typical flashing and stone coping details protect against water penetration. Acoustical insert possibilities are numerous. Used as an acoustical wall, the block could have a fabric-faced acoustical insert or any number of surface treatments. Fire and smoke barriers are applied to the biaxial openings as with any fire barrier penetration.

A broad range of esthetic possibilities is available with the Bi-X block, since the exposed Bi-X access openings can be used for space differentiation, to articulate particular areas, or to support facing materials like wood, stone, or glass.

The block's openings facilitate construction by providing hand holds for the masons. Although Bi-X blocks are lighter than standard CMUs, their compressive strength is decreased little if at all, according to NCMA tests, because the holes are configured to act like the openings of arches.—DOUGLAS GORDON

The National Concrete Masonry Association Circle 261 on information card

ROOFING

Releases on roofing products outnumber all others this magazine receives by a ratio of two to one. The following are some of the more innovative roofing products developed recently, starting with insulation.

Roof Insulation Products

A line of roof insulation products from ARCO consists of cellular polystyrene factory-bonded to fire-resistant inorganic chemical board. ARCOR FM-1 insulation is a Factory Mutual Class I board bonded on both sides for use with asphalt built-up roofing (BUR), modified bitumen, and single-ply membrane systems. ARCOR SP insulation is bonded on the bottom for direct application to metal decks and for use in loosely laid ballasted single-ply systems. This insulation board is also recommended for double-layer applications. ARCOR MB insulation is a top-side bonded board that can be applied over structural concrete, wood, or existing roof systems. Compatible with asphalt BUR systems, it can also be used with loose-laid, mechanically fastened, or modified bitumen single-ply systems. The products are available in flat stock form or factory tapered to provide roof drainage.

Carlisle's rigid, lightweight Sure-Seal EPS insulation boards made of expanded polystyrene are designed to be easy to cut and shape. A high compression strength enables them to withstand foot traffic and the weight of stone ballasts. Tapered systems are available.

A plastic "locking" plate by Cooley protects roofing membranes from damage and is said to eliminate the potential for fastener backout and membrane rupture. The plate locks the head of the fastener into place on the plate with an audible "pop," indicating the fastener is sufficiently driven. The plate and fastener will continue to remain above the insulation in a single unit should the insulation material deteriorate or lose thickness. The plate's three-inch surface helps prevent immediate damage and allows for detection and repair before a leak forms. Constructed of a polyethylene material, the plates meet or exceed Factory Mutual corrosion-resistance standards.

Although not strictly a roofing insulation but rather an ice and water barrier, the Weather Watch by GAP protects roofs against the potential hazards caused by...
ARCO Chemical Company

The reflective white film helps maintain waterproofing for steel stud construction, and to be bacteria- and fungus-proof. As a vapor barrier for roofs, walls, and floors, the Icebreaker has a self-adhesive backing that provides a positive seal around roofing nails and penetrations. The reflective white film helps maintain adhesion by reducing the membrane ambient temperature. It is said to be unaffected by cracking, rot, or dessication and to be bacteria- and fungus-proof.

ARCO Chemical Company
Circle 241 on information card

Carlisle SynTec Systems

The Icebreaker, marketed by Teltex, is a flexible waterproofing membrane made of white polymer sheeting and rubberized asphalt. When installed under shingles, shakes, tile, and metal roofing, the membrane prevents water back-up from ice dams and leak damage caused by wind-blown rain. The waterproofing underlayment doubles as an air infiltration barrier around doors and windows, as wall water-proofing for steel stud construction, and as a vapor barrier for roofs, walls, and floors. The Icebreaker has a self-adhesive backing that provides a positive seal around roofing nails and penetrations. The reflective white film helps maintain adhesion by reducing the membrane ambient temperature. It is said to be unaffected by cracking, rot, or dessication and to be bacteria- and fungus-proof.

ARCO Chemical Company
Circle 241 on information card

Carlisle SynTec Systems

The Reflective White Film helps maintain waterproofing for steel stud construction, and to be bacteria- and fungus-proof. As a vapor barrier for roofs, walls, and floors, the Icebreaker has a self-adhesive backing that provides a positive seal around roofing nails and penetrations. The reflective white film helps maintain adhesion by reducing the membrane ambient temperature. It is said to be unaffected by cracking, rot, or dessication and to be bacteria- and fungus-proof.

ARCO Chemical Company
Circle 241 on information card

Carlisle SynTec Systems

The Icebreaker, marketed by Teltex, is a flexible waterproofing membrane made of white polymer sheeting and rubberized asphalt. When installed under shingles, shakes, tile, and metal roofing, the membrane prevents water back-up from ice dams and leak damage caused by wind-blown rain. The waterproofing underlayment doubles as an air infiltration barrier around doors and windows, as wall water-proofing for steel stud construction, and as a vapor barrier for roofs, walls, and floors. The Icebreaker has a self-adhesive backing that provides a positive seal around roofing nails and penetrations. The reflective white film helps maintain adhesion by reducing the membrane ambient temperature. It is said to be unaffected by cracking, rot, or dessication and to be bacteria- and fungus-proof.

ARCO Chemical Company
Circle 241 on information card

Carlisle SynTec Systems

The Icebreaker, marketed by Teltex, is a flexible waterproofing membrane made of white polymer sheeting and rubberized asphalt. When installed under shingles, shakes, tile, and metal roofing, the membrane prevents water back-up from ice dams and leak damage caused by wind-blown rain. The waterproofing underlayment doubles as an air infiltration barrier around doors and windows, as wall water-proofing for steel stud construction, and as a vapor barrier for roofs, walls, and floors. The Icebreaker has a self-adhesive backing that provides a positive seal around roofing nails and penetrations. The reflective white film helps maintain adhesion by reducing the membrane ambient temperature. It is said to be unaffected by cracking, rot, or dessication and to be bacteria- and fungus-proof.

ARCO Chemical Company
Circle 241 on information card

Carlisle SynTec Systems

The Icebreaker, marketed by Teltex, is a flexible waterproofing membrane made of white polymer sheeting and rubberized asphalt. When installed under shingles, shakes, tile, and metal roofing, the membrane prevents water back-up from ice dams and leak damage caused by wind-blown rain. The waterproofing underlayment doubles as an air infiltration barrier around doors and windows, as wall water-proofing for steel stud construction, and as a vapor barrier for roofs, walls, and floors. The Icebreaker has a self-adhesive backing that provides a positive seal around roofing nails and penetrations. The reflective white film helps maintain adhesion by reducing the membrane ambient temperature. It is said to be unaffected by cracking, rot, or dessication and to be bacteria- and fungus-proof.

ARCO Chemical Company
Circle 241 on information card

Carlisle SynTec Systems

The Icebreaker, marketed by Teltex, is a flexible waterproofing membrane made of white polymer sheeting and rubberized asphalt. When installed under shingles, shakes, tile, and metal roofing, the membrane prevents water back-up from ice dams and leak damage caused by wind-blown rain. The waterproofing underlayment doubles as an air infiltration barrier around doors and windows, as wall water-proofing for steel stud construction, and as a vapor barrier for roofs, walls, and floors. The Icebreaker has a self-adhesive backing that provides a positive seal around roofing nails and penetrations. The reflective white film helps maintain adhesion by reducing the membrane ambient temperature. It is said to be unaffected by cracking, rot, or dessication and to be bacteria- and fungus-proof.

ARCO Chemical Company
Circle 241 on information card

Carlisle SynTec Systems

The Icebreaker, marketed by Teltex, is a flexible waterproofing membrane made of white polymer sheeting and rubberized asphalt. When installed under shingles, shakes, tile, and metal roofing, the membrane prevents water back-up from ice dams and leak damage caused by wind-blown rain. The waterproofing underlayment doubles as an air infiltration barrier around doors and windows, as wall water-proofing for steel stud construction, and as a vapor barrier for roofs, walls, and floors. The Icebreaker has a self-adhesive backing that provides a positive seal around roofing nails and penetrations. The reflective white film helps maintain adhesion by reducing the membrane ambient temperature. It is said to be unaffected by cracking, rot, or dessication and to be bacteria- and fungus-proof.

ARCO Chemical Company
Circle 241 on information card

Carlisle SynTec Systems

The Icebreaker, marketed by Teltex, is a flexible waterproofing membrane made of white polymer sheeting and rubberized asphalt. When installed under shingles, shakes, tile, and metal roofing, the membrane prevents water back-up from ice dams and leak damage caused by wind-blown rain. The waterproofing underlayment doubles as an air infiltration barrier around doors and windows, as wall water-proofing for steel stud construction, and as a vapor barrier for roofs, walls, and floors. The Icebreaker has a self-adhesive backing that provides a positive seal around roofing nails and penetrations. The reflective white film helps maintain adhesion by reducing the membrane ambient temperature. It is said to be unaffected by cracking, rot, or dessication and to be bacteria- and fungus-proof.
Hertz has money-saving news for all AIA members.

Now you can get a 10% discount off Hertz Affordable Rates—or a 5% discount off Hertz Affordable Weekend—whenever you rent a compact or larger car from #1.

You’ll save big on daily rentals too with the special U.S. Rates:

<table>
<thead>
<tr>
<th>Car Class</th>
<th>Daily Rate*</th>
</tr>
</thead>
<tbody>
<tr>
<td>compact</td>
<td>$36.00</td>
</tr>
<tr>
<td>intermediate 2 Door</td>
<td>$42.00</td>
</tr>
<tr>
<td>intermediate 4 Door</td>
<td>$44.00</td>
</tr>
<tr>
<td>intermediate 4 Door</td>
<td>$46.00</td>
</tr>
</tbody>
</table>

The AIA Discount Program is available at participating Hertz locations across the country. Simply present your AIA Executive Card to receive these special discounts.

Watch for it, and call our “Members Only” Desk toll-free at 800-654-2200 for reservations and information.

You can also save $300 off the retail price or get a $500 U.S. Savings Bond when you buy a quality Hertz Used car. Call 800-848-3424 for your coupon and the car sales location nearest you.

Don’t just rent a car. You rent a company.

**Hertz rents Fords and other fine cars**

Circle 15 on information card
panels can be used for vertical or inclined applications down to 3:12 slope and are designed to provide maximum wind uplift resistance, and minimum deck and structural loading. The HP-75 system also contains a compounded fire retardant for additional safety. The system is sold for new construction or where old roofing and insulation is being completely removed. This system includes a vinyl sheet vapor barrier to be installed over clean decking so that the insulation remains protected. The Versigard system is available in black or white, comes in 100-foot rolls, 12 feet wide, and is backed by a 20-year warranty.

Goodyear
Circle 259 on information card

Copper Roofing
ASC Pacific, a manufacturer of steel building products, offers a roll-formed copper in standing seam or batten profiles. Available in 16-ounce half-pure copper in a smooth or textured surface, the panels can be used for vertical or inclined applications down to 3:12 slope and are flexible for hip, mansard, and soffit conditions. Several paint finishes are offered, including a metalepasceous fluorocarbon called New Penny Copper and an acrylic copper system, Thermo Aging Copper, which changes color as it ages. The aging coloration or “patina” process can be accelerated by applying an acid bath.

ASC Pacific Inc.
Circle 256 on information card

Infrared Heat Scanners
Two technically advanced hand-held infrared heat scanners are available from Prospect Technologies. The Roof-TK Fire-Scanner minimizes the fire hazard associated with torch-applied modified bitumen membranes by detecting temperature variations in roof deck areas caused by smoldering combustion in the roof deck, insulation, penetrations, perimeters, and other roofing detail areas. When the pocket-sized portable unit, which is used much like a flashlight, detects a “hot spot” with its beam it emits an audible alarm if the temperature rise is greater than 25 degrees Fahrenheit over a previously established deck reference temperature. The increase in infrared heat radiation is shown on a three-color LED display scale.

Bitumen temperatures for BUR and modified bitumen systems can be monitored at the point of application with the Roof-TK Bitumen Temp Scanner. The Temp Scanner’s infrared thermometer provides instant job-site temperature readings at the kettle, mop bucket, and point of application on a digital display screen when the unit is held close to the area in question. The Bitumen Temp Scanner is said to be accurate to within two degrees Fahrenheit within a range of 10 degrees Fahrenheit to 550 degrees Fahrenheit. Both scanning units come equipped with a belt carrying pouch and operate on standard nine-volt alkaline batteries.

Prospect Technologies Inc.
Circle 258 on information card

Single-Ply Roofing Membrane
Versigard HP-75, a 75-mil-thick, single-ply synthetic rubber roofing membrane introduced in March, is designed to be fully adhered to a hard insulation laminate and compounded to provide greater resistance to aging. The membrane reputedly has an ideal level of expansion and contraction to compensate for the movement of buildings during thermal changes. The nonballasted, fully adhered system is designed to provide maximum wind uplift resistance, and minimum deck and structural loading. The HP-75 system also contains a compounded fire retardant for additional safety. The system is sold for new construction or where old roofing and insulation is being completely removed. This system includes a vinyl sheet vapor barrier to be installed over clean decking so that the insulation remains protected. The Versigard system is available in black or white, comes in 100-foot rolls, 12 feet wide, and is backed by a 20-year warranty.

Goodyear
Circle 259 on information card

Roof Drains and Expansion Couplings
Carlisle’s Sure-Seal roof drains are made of PVC and lightweight plastic. The drains are designed to resist rust and corrosion and to be compatible with any piping system and adaptable to all types of roof construction. A raised dome provides protection against clogging. Expansion couplings are designed to connect the roof drains with various types of piping systems. Each coupling comes with two clamping rings.

Carlisle SynTec Systems
Circle 260 on information card

Asbestos-Free Cement Siding
Rigid, fiber-reinforced cement slates for roofing are designed to be noncombustible and contain no asbestos. The blue-black roofing slates can also be used for fascias, mansards, and facades, and are available in either a smooth or textured finish. They are appropriate for new construction as well as for remodeling. A color brochure is available.

Eternit Inc.
Circle 257 on information card

NEW AND NOTEWORTHY

Lead-Rubber Bearings for Seismic Design
One solution to the problem of designing in earthquake-prone areas is to use the base isolation concept, which permits a building or a bridge structure to be substantially decoupled from the ground so that earthquake-induced ground motion is significantly dissipated before being transmitted to the structure. Flexibility, wind resistance, and energy dissipation are built into a bearing unit, composed of a lead plug and alternate layers of rubber and steel and encased in a vulcanized rubber cover.

The lead plug, which fits into the center of the unit, provides wind resistance and seismic damping. It allows a building to displace approximately three to six inches at the unit during an earthquake and then to reposition after the stresses are removed. The rubber bearings reputedly can reduce the seismic forces acting on a structure by factors of five to 10. Because they remain elastic for wind loads, additional mechanisms for wind resistance are not necessary.

Lead-rubber bearings range in standard size from six to 36 inches square; other sizes and shapes are available. They are placed as column bases, or at the top of bridge piers, and can be designed into new and retrofit structures.

The company has developed preliminary design procedures for its system and will assess the most practical and economical solution for a particular project.

Dynamic Isolation Systems Inc.
Circle 262 on information card

Pipe Deicer
“No-Freeze” drain pipe deicer works without electricity to keep drainpipes from becoming ice-clogged. The “No-Freeze” deicer is constructed of a brass canister filled with ice-melting crystals and has adjustable legs that fit into the top of any drainpipe. The unit is harmless to shrubbery, flowers, and grass and comes with a money-back guarantee.

Aeroil Products
Circle 263 on information card

Elastomeric Waterproof Sheeting
Londeck PVC vinyl sheeting is a lightweight, sound-absorbing, waterproof covering for outdoor walking decks and balconies, as well as a complete single-sheet roof covering system. Designed for resistance to foot traffic, the effects of sun and water, and industrial chemicals, the sheeting can be installed on plywood, concrete, metal, or magnesite substrates.

The three-layer laminated PVC sheeting has a center layer designed for maxi-
mum elongation properties and a bottom layer molded to a backing cloth that provides stabilization and additional strength while increasing the surface area of the sheet and the bonding strength of the adhesive.

The vinyl sheeting is manufactured in 57- and 72-inch widths, in rolls 60 feet long, and sheeting comes in five stock colors. Lonseal Circle 264 on information card

Wooden Art Cabinets
Cabinets fabricated of quality birch or oak plywood and finished in a medium walnut stain have a Formica top in wood grain, white, or gray. The Formica top permits the cabinet also to be used as a worktable.

The cabinets are designed to store standard 30x40-inch artboards, flats, blueine paper, and similar materials. Dimensions of the standard cabinet are 40 inches high, 45 inches wide, and 33½ inches deep. An open storage area, 42½ inches wide by 9½ inches high, is provided at the bottom of the cabinet. Custom cabinet sizes are also available. Brian's Custom Woodworks Circle 265 on information card

Windows With High-Performance Glazings
Low-emissivity glazings in a variety of shapes and sizes such as squares, rectangles, right-angle triangles, and trapezoids are available with high performance, and high-performance insulating glass.

Flexiframe windows can be ordered in any size up to 72x96 inches. Wood subframes are clad with reinforced engineered plastic; the inside facing is of natural wood. Units are available in white or earth tones to match the manufacturer's Perma-Shield line for double-hung, casement, awning, and picture windows, roof windows, and patio doors. Andersen Windows Circle 266 on information card

CREDITS


Professional LIABILITY INSURANCE for Architects with a leading national insurer through PCM Intermediaries, Ltd.

SPECIALISTS IN PROFESSIONAL (Non-Medical) COVERAGE

Ask your agent or broker to contact us for details.

Yes! Send me information about how I can plan ahead with the AIA Accidental Death and Dismemberment Insurance Plan. I understand there is no obligation.

Name)

Address)

City)

State, ZIP)

Send completed coupon to:

AIA Insurance Plans
400 Locust Street, 8th Floor
Des Moines, Iowa 50398

Brochure to contact

Circle 34 on information card
ADVERTISERS

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 (215) 524-9800
James A. Bauschka
995 Old Eagle School Rd., Suite 301
Wayne, Pa. 19087

Midwest (312) 663-4116
Jack E. Bergren
Barbara Mitchel Friscia
53 West Jackson Blvd., Suite 205
Chicago, Ill. 60604
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

Circle No.  Page No.
5 American Gas Assoc. . . . . . . . . . . . . . . . . 11
J. Walter Thompson Co. .................................. 15
AIA Executive Services .................................. 117
25 AIA Prof. Systems .................................. 98
32 American Plywood .................................. 26
Borders, Perrin & Norrandner .................. 1
Armstrong Cov. 2-p. 1
Marsteller Inc. .................................. 1
2 Armstrong .................................. 2-3
3 Armstrong .................................. 4-5
Marsteller Inc. ..................................
30 Autodesk, Inc. .................................. 110
BASF Fibers .................................. 103
35 Cabot .................................. 19
Ingalls, Quinn & Johnson .........................
27 CalComp Systems, Inc. ................. 100
Jansen Assoc. Inc. ..................................
24 California Redwood Assoc. .............. 95
Foote, Cone & Belding, Inc. ................
17 Curries Manufacturing, Inc. .......... 28
Colle & McVoy ..................................
8 Ebco Manufacturing Co. ................. 14
Fahlgren & Swink, Inc. .........................
29 Follansbee Steel Corp. ................. 104
Group Marketing & Communications ....
31 Fry Reglet .................................. 114
McNall & Blackstock .........................
14 GAF Building Material Corp. .......... 25
20 General Electric ............................. 72-73
Symon & Hilliard Inc. .........................
13 Hartmann-Sanders Co. ................. 23
Vensure Ltd. ..................................
18 Haws Drinking Faucet Co. ............ 30-31
Mandabach & Simms/Pacific, Inc. ....
36 Hewlett-Packard ................. Cov. 3
Leo Burnett U.S.A. .............................

Circle No.  Page No.
16 Hikari International ........................ 27
9 Hordis Brothers, Inc. ......................... 17
11 Kalwall Corp. ................................ 24
Synerjenn Adv. Inc. .........................
33 Kirke Van Orsdel .......................... 119
6 Koppers Co. Inc. .............................. 12
The Advertising Center ..................... 74
21 LCN Closers ................................
Frank C. Nahser, Inc. .........................
22 Manville Roofing Systems ............ 88-89
Broyles, Allebaugh & Davis, Inc. ......
26 Minolta Corp. ................................ 99
7 Morton Thiokol, Inc. ....................... 13
4 Olympic Stain ................................ 8-9
Young Rubicam San Francisco .........
34 PCM Intermediaries, Ltd. ............... 119
12 Pozzi Windows ................................ 22
Mandala Communications .................
10 Red Cedar Shingle ......................... 21
Cedarcrest Adv. ................................
37 Sloan Valve Co. ............................ 4
McKinney, Inc. ................................
23 Vistawall Architectural Products .... 90
Homsey Adv. ................................ 32
19 Von Duprin ................................
Time is of the essence. The essence of the HP DraftMaster Plotter. The fastest A to E size drafting plotter made by Hewlett-Packard. A plotter so fast, any designer can create big ideas at blinding speeds.

How did we do it? With unsurpassed acceleration. And features like a new pen-sorting algorithm. Bi-directional plotting. And a very fast resident micro-processor. We even offer a model with roll-feed for non-stop plotting.

But the HP DraftMaster doesn't sacrifice output quality for its blinding speed. Every plotter is thoroughly tested to ensure the highest reliability and precision. So you get smooth arcs, straight lines and perfectly-formed characters, time after time. Furthermore, it handles a variety of pens on drafting film, vellum or paper—all at optimal speeds.

Naturally, it works with just about any computer. Like the HP Vectra PC and IBM PC's. As well as popular PC-CAD software like AutoCAD and VersaCAD. And the DraftMaster brings with it HP's worldwide reputation for quality. Prices start at just $9,900.

Why wait? For a brochure and a sample plot, call us at 1800367-4772, Ext. 901A.

The drawing shown below was produced on the HP DraftMaster with AutoCAD software.

How to create monumental plots in a matter of minutes.
Six major reasons to specify Sloan...

At first glance, it's difficult to imagine how these six different buildings are related. But if you take a closer look at their histories, you'll find they all share a common theme: the washrooms in all six buildings have been refitted with Sloan flushometers.

True, these buildings don't look old enough to need major plumbing repairs. But the fact is, the original flushometers that were installed just didn't hold up. Even after repeated servicing, they continued to malfunction. They didn't shut off properly. They leaked at the stops. In some cases, they even flooded the washrooms. In short, they weren't Sloan flushometers.

Unlike substitutes, Sloan flushometers offer proven, reliable service. With built-in quality at an affordable price. That's why today more buildings are equipped with Sloan flushometers than with any other brand.

Only Sloan's rugged, tamper-proof design can assure the quiet, dependable operation so critical in buildings like these. Plus, Sloan flushometers are built to last for years with only minimal, routine maintenance—an important consideration for specifiers who value time and money.

The next time you consider specifying a substitute, think about these six buildings. Then specify Sloan. The first time.

1. Psychiatric Center of Michigan Hospital, New Baltimore, MI  2. YMCA of Raleigh, NC
3. Barnett Bank, Tampa, FL  4. S.E. Louisiana University School of Nursing, Baton Rouge, LA

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