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FESTIVAL THEATER, CAESAREA, ISRAEL

IOWA STATE AUDITORIUM

BUILDING TYPES STUDY: HOSPITALS

SEMI ANNUAL INDEX ON PAGES 152-155

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ARCHITECTURAL RECORD

DECEMBER 1970

12

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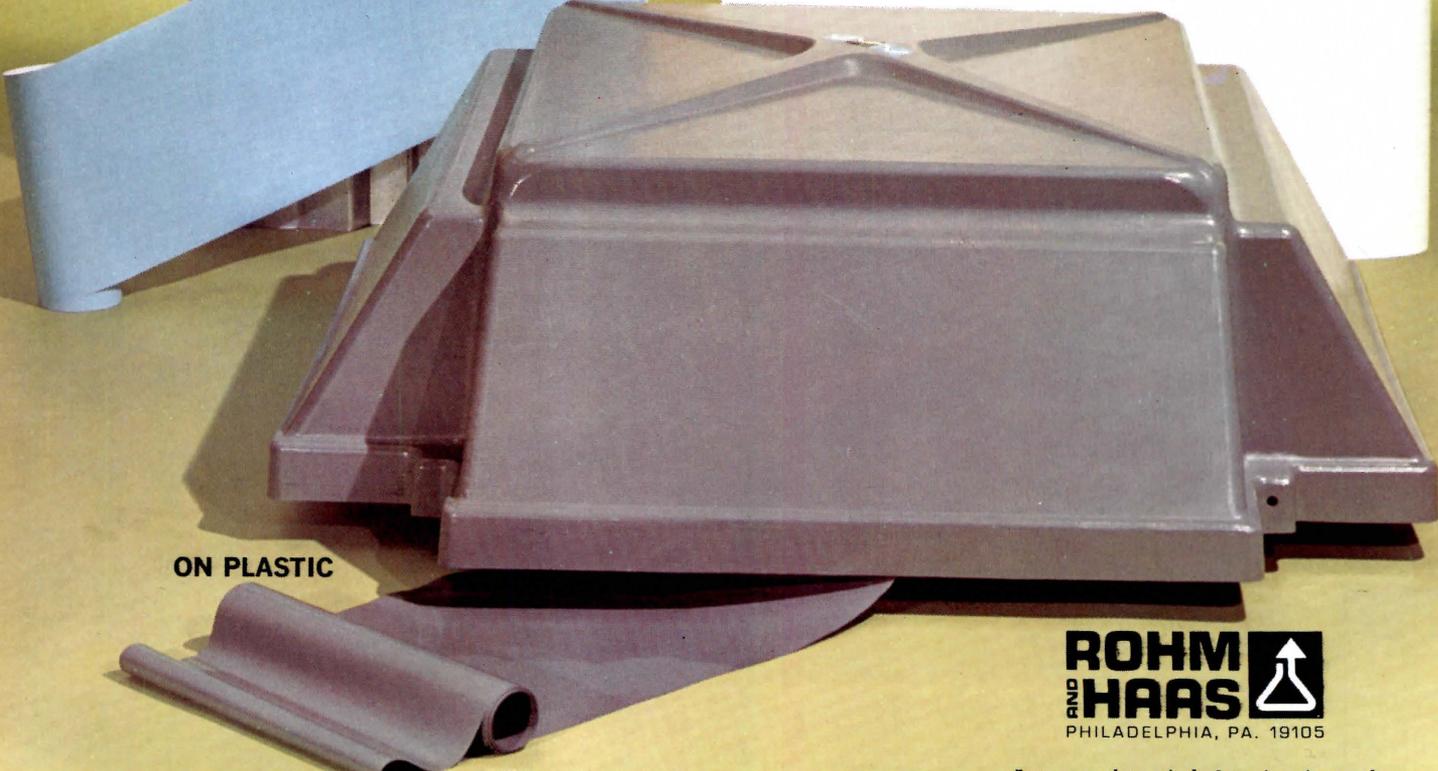
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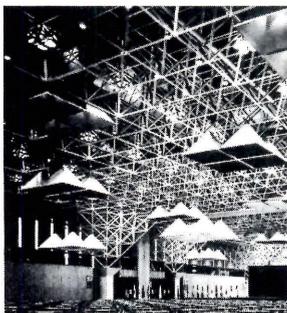
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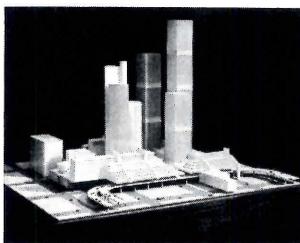
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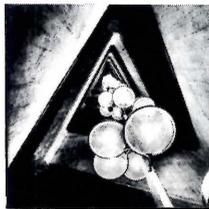
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39 Let's clear up laws on copyright of plans

Plans can be copyrighted, but
buildings can still be copied, according
to John Warren Giles, Washington
attorney. Architects should seek
opportunities to point out to
legislators that plans are neither
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represent unique designs for
which protection is required.

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The 1970 Federal Aid Highway Act
provides for extending the Highway
Trust Fund and is expected to pass
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with mass transit and airport
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The Festival Theater in Caesarea, Israel consists of a moveable steel acoustical shell over the stage of a partially restored Roman theater. George C. Izenour, designer of the shell and noted theater consultant and scholar traces its development and describes his design solution—and in so doing reveals himself once more as a steady foe of the conventional wisdom which still prevails among many who design for the performing arts.

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On a site near Yosemite, architect John Rex built a house for his family that serves as the nucleus for a working cattle ranch.

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Henk Snoek

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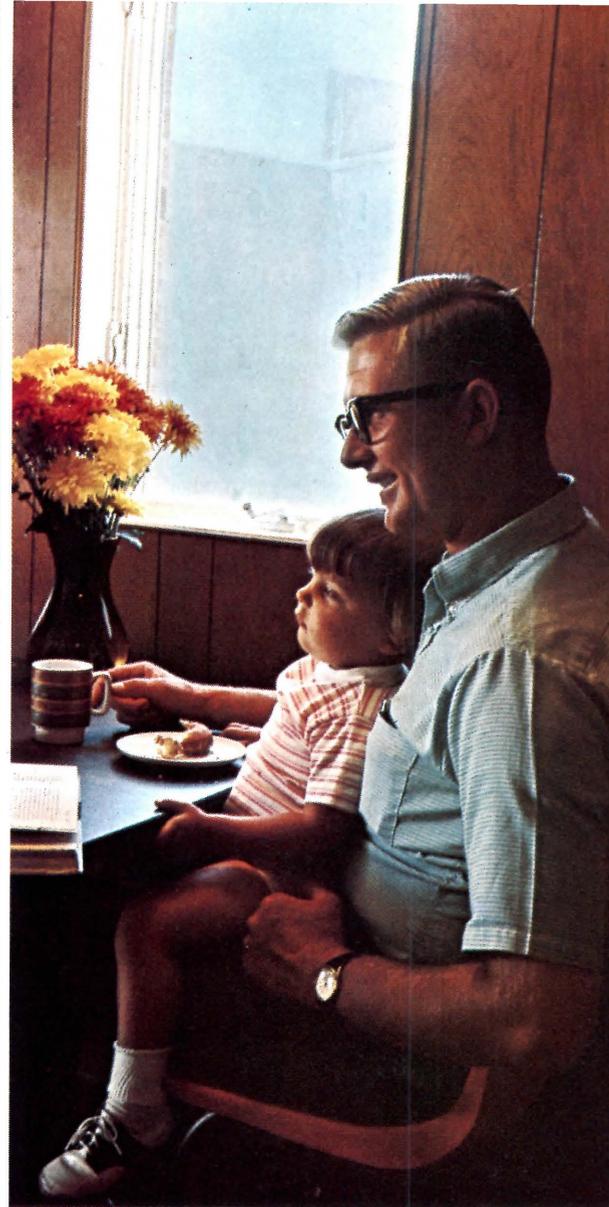
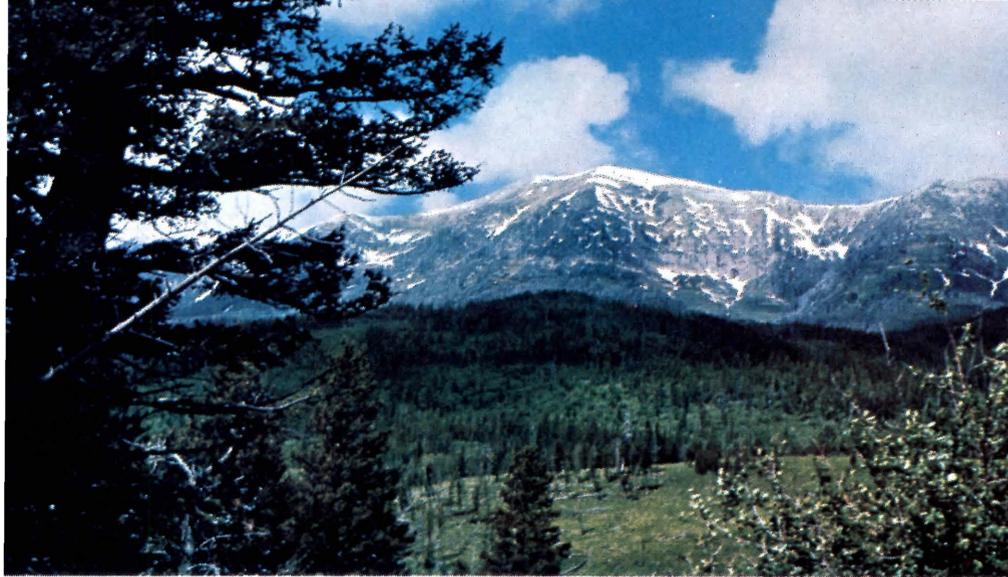
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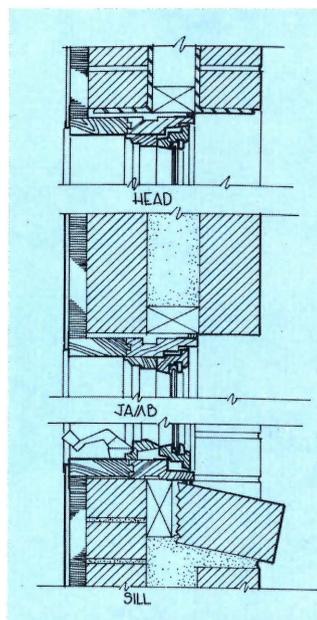
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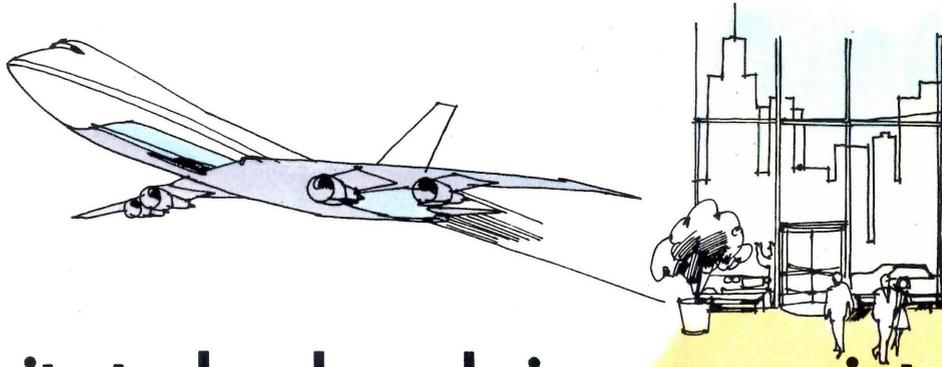


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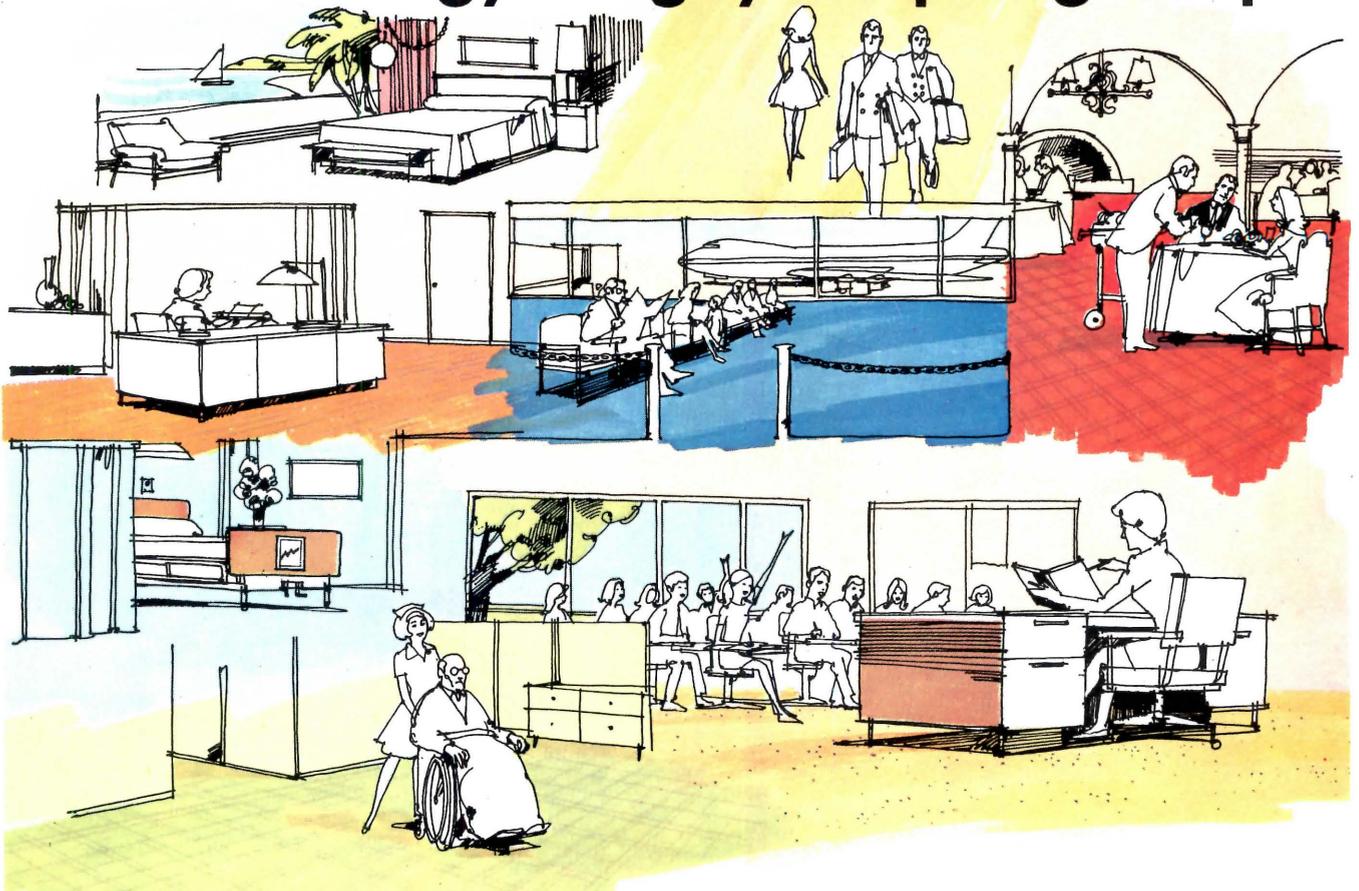
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Functioning at the new scale; coming soon, superscale

Sometimes it seems more than a body can stand. It seems like there's enough trouble for architects and engineers what with cut-backs, higher and higher building and financing costs, systems approaches and systems hardware, new and more difficult roles for everyone operating at "the new scale."

And now, as if "the new scale" is not enough, along come some people (like A.I.A.'s executive vice-president Bill Slayton and BRAB's executive director Robert Dillon) who suggest we ought to start thinking and worrying (in terms of our own and the public's welfare) at what can only be called superscale. And they're right.

In a speech made last month, BRAB's Dillon suggested that while we have begun saying "as a nation, we can have anything we want but probably not everything we want," we really don't believe it. He argued that: "... beginning with World War II, we learned that with our resources, energy and productive capacity, we needed only to 'lean' on a problem or 'grasp' for an achievement and it was ours. Think of them. The development of atomic energy, the polio vaccine, man landings on the moon, jet travel, the interstate highway system, even television and air conditioning. In short, if housing and urban development and redevelopment are made the number one priority and we 'lean', we can probably turn on the engine of production and produce those millions of units and that environmental renaissance we seek." Right? Wrong, says Dillon (and he's right, and here comes superscale): "Two things have been happening. First, by shifting from one national

priority to the other in an attempt to do and have more and more, we have spread ourselves perilously thin and even been forced to accept some over-development and 'flame-outs', such as in aerospace, with the attendant disruptions and dislocations of whole industries and the lives of millions of our people. Second, we seem suddenly [and one might add, at last] aware that we are more and more fueling our great productive engine with the resources of others. Only in bulk non-metals such as earth, sand, gravel, and the like—and a few low-volume metals—are we truly self sufficient today. . . . And one by-product has been the despoiling of our [and other people's] environment." Superscale? You bet!

A.I.A.'s Bill Slayton, in a speech last month to the American Society of Civil Engineers (that's new-scale right there) offered some other concerns for architects and engineers at the superscale level: "We have designed the urban highway to transport people from point A to point B, giving no more than token attention to the highway's impact on the environment between A and B. Also, we have designed the urban highway to meet urban growth on the assumption that urban growth will generally follow the projection of past trends, rather than designing the urban highway to encourage urban growth in those areas where we wish urban growth to occur and discourage growth in those areas where we do not wish it to take place. . . . This is a simple example of our failure to devise systems [another use of that all-purpose word] to make use of the components [like highways, or housing for low-income families] designed by the environ-

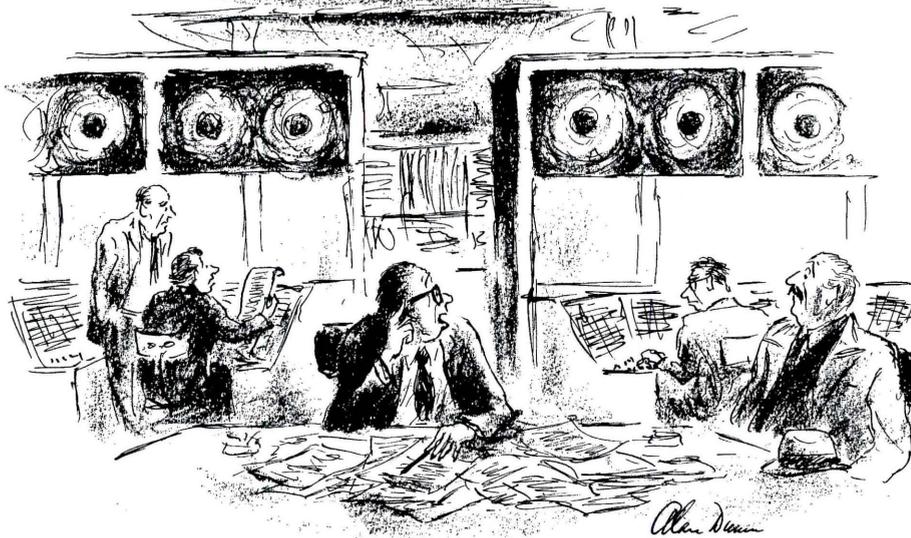
mental design professions. We have not used the design of these components to achieve more sophisticated objectives [that is, a better urban environment]."

What kind of a "system" do we need to accomplish that? In Slayton's view (and here comes superscale again) "The client will have to be the public, and the public will have to be represented by a public agency which is concerned with the environment as a whole rather than with a piece of it. . . . This means the environmental design professions should become advocates of a system that creates public clients concerned with . . . the design of both the expanding urban areas and the worn-out portions of our central cities."

Such clients are needed, Slayton argues, because "society generally can only point to the ills, describe the deficiencies, and evidence dissatisfaction. There needs to be created the mechanism to translate those concerns into means of producing the good environment." Superscale? You bet!

The theme of 1971's A.I.A. Convention in Detroit, says new president Bob Hastings, will be "The Hard Choices." He wants (and he's right because it is essential) a hard discussion of the hard choices that must be made by professionals, by suppliers, and by the public which we're all a part of. Hard choices like: Do we really want to pay the price to give everyone a free choice of housing? . . . How's the land going to be made available? . . . Do we really want to rebuild our cities? . . . Are we willing to pay the price for removing pollution? Hard choices that will affect the way we live.

Well, we're far from solving our new-scale problems, and we're into superscale. And it's a good thing we are. Because the superscale problems aren't going away—and if we don't face them and solve them, we're through as biological creatures and/or as civilized men. —Walter F. Wagner, Jr.



"We can build you a computer that makes a building-cost estimate possible, but damned if we can estimate the cost of the computer!"

Some thoughts on education by a thoughtful architect

In October, in her article on "A New Professional Conscience" (pages 118-127), Mildred Schmertz wrote that "Today's good architect . . . tirelessly re-examines basic concepts and makes social and ethical assessments of far greater subtlety than in the past. He knows that everything must be thought through again and that is how he starts."

As one more intensely interesting and evocative evidence of that, below is reproduced a paper written not for publication, but for thought and discussion within the firm, by Sarah P. Harkness, one of the founding partners of The Architects Collaborative (which has done over 80 schools in the past 20 years). In Mrs. Harkness' words: "A child comes home from school saying, 'What's the point of learning all this junk when I don't remember it anyway?' New methods and greater intensification of education have resulted in sharper brains. But what good is a sharpened tool if you don't know what to do with it?"

"Universal education in its simplest ABC terms, was originally set up to make people literate so that they could do better the jobs they had to do. School was secondary to getting the work done around the farm. A child could hate school and still have something left. But nowadays 'home'—although it is still an active place for small children and serves as a retreat for the whole family—has lost its connection with the outside world. We assume a background for school studies that no longer exists. Increasing emphasis on symbolism or abstraction is increasingly meaningless as the things symbolized or abstracted are removed from the students' lives.

"It seems that school will have to develop connections with the outside world and at the same time reconstitute a relation to life itself.

"Would it be possible, instead of sending students out into business, to bring small businesses into the school?"

"Types of business or enterprise that come to mind are hamburger stands, or small eating places that would take the place of the school lunchroom; day nursery and nursery school, which would in turn enable teachers with babies and small children to continue teaching; boarding house for students who need to live away from home; children's zoo; movie theater; dramatic groups; bicycle repair shop; radio repair; sandal shop; toy store; photographic studio; and so on. The faculty and guidance department should help a student set up a suitable work-study program and be responsible for making connections with academic subjects. Mathematics, accounting and economics relate to business enterprise. In-depth study of a hamburger might find out about cattle-raising and include a visit to the slaughterhouse; or at the other end, find out about nutrition and health. Working in a day nursery would have to include psychology and child development, the areas that are so much needed by future parents, and have been so neglected. Bicycle repair leads into a study of physics and transportation, as well as the appreciation of a beautiful mechanism. The practice of design and building should run through everything with graduate students of art and architecture as part-time teachers. Instead of the present system of abstract grades, rewards and punishments should be intrinsic in the success or failure of the enterprise, or in the experience gained.

"The school would become a village. The inhumanly large number of same-age students (which seems to be the only answer to integration) would include more adults, while one to one relationships both between adults and students and between older and younger students could take place. Although the school community would be larger, the scale would be broken

into small parts. Useful skills and trades would be picked up, while mutual respect should have a chance to grow. Payment for jobs done would not be out of place but a special currency might be used. Like a balanced aquarium, the village could be a microcosm, a model for experiment and discovery in government, economics and environmental design. Parents should be part of the scene, shopping, watching a performance, appreciating what their children can do.

"The village would focus on a marketplace. Architecturally, this might be a large vaulted shelter or inflated structure within which boutiques, platforms, art work, etc. could be built and unbuilt without having to cope with the complications of weather. Academic studies would take place in laboratories, offices and library-research facilities connected with village life.

"Even more basic than the connection with the present day civilized world should be the connection with nature and with one's own origins. If we don't develop this relationship there will be no nature left. But beyond this, can we understand the present technological society without understanding the human and natural elements that it is built upon? We might turn to the "Outward Bound" or "NOLS" [National Outdoor Leadership School] for guidance. A school could have a wilderness location, as well as an urban one. Connections with academic subjects such as anthropology, ecology, history and literature are obvious. A further development from basic survival would be that the camp group could gradually move towards civilized life by "inventing" the things that seem to be the most needed—shelter, tools, transportation, sanitary facilities, etc. The next step would be farm life, and finally, the central urban campus (described before) would bring high school students to the threshold of the problems of government, industry and modern life."

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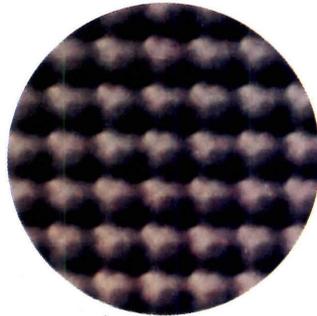
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waiting time. It responds instantly to changing
situations. Actually anticipates calls.

VIP-260 is the most advanced elevating
system ever devised. Our engineers spent
years on it.

To save you a few moments every day.

Otis[®]
The Elevator Company





John H. Summer & Associates had two big reasons for specifying All-Electric design for the new Honeywell Building in Atlanta, Ga.

And building owner A. R. Weeks had seven big reasons to be thankful.

The first big reason was design flexibility. By going All-Electric, the architects had the freedom to design a unique and distinctive building. Regardless of design, there's an All-Electric system to fit any building.

The second big reason was operating economy. Feasibility studies showed that an All-Electric heating and cooling system would cost 10% less to operate than any other fuel system!

Besides these two advantages, Mr. Weeks gained five additional benefits from All-Electric design:

- initial cost savings over the other systems were substantial.

- flameless electric heating is steady, even and quiet. It gives greater comfort!
- with fewer moving parts, electrical equipment is remarkably dependable and virtually service-free.
- All-Electric heating systems don't require bulky furnaces and boilers. You get more usable space!
- electrical equipment is easier and faster to install. It saves on labor costs!

It's no wonder more and more architects are specifying All-Electric design. Electric utility companies will be glad to work with you.

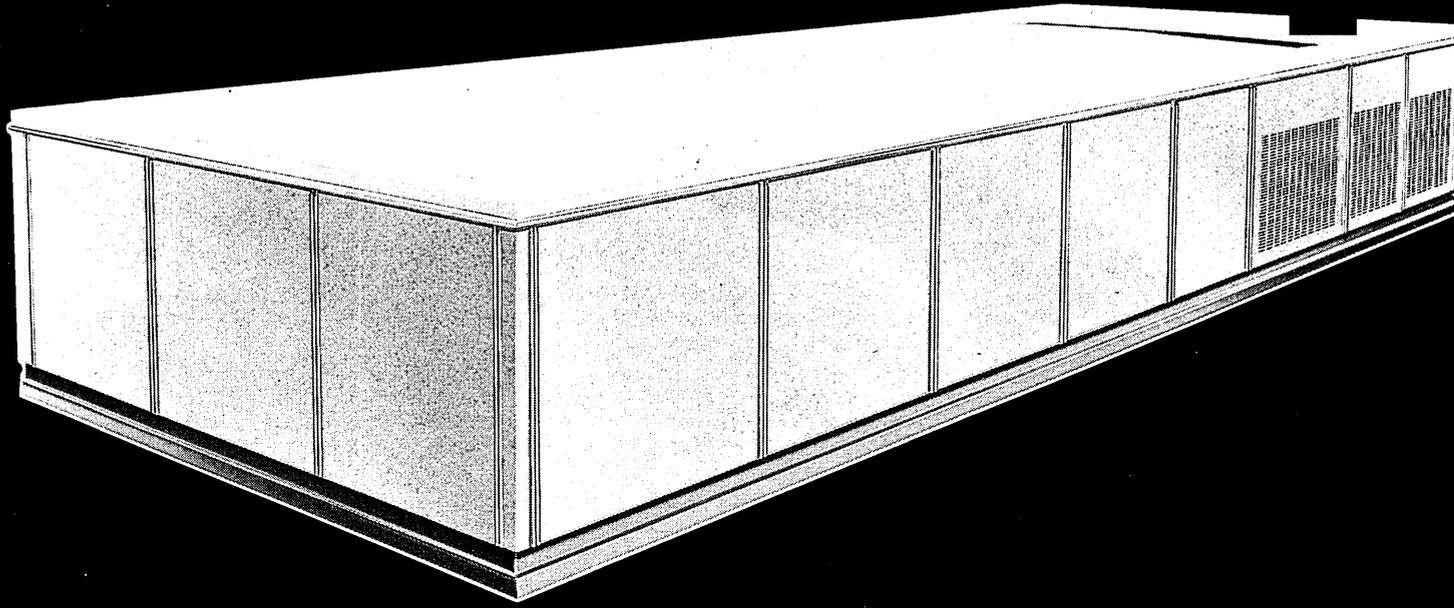


Live Better Electrically

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For more data, circle 9 on inquiry card

What we've done to make Schemenauer rooftop units* the most reliable.



*Multizone systems for:

1. Heating-cooling-ventilating
2. Heating-ventilating with optional provision for future cooling
3. Cooling-ventilating

What is reliability?

To a building owner it means comfort he can depend on. It means low fuel and power consumption. And it means absolute minimum maintenance.

To an architect, and an engineer, it means satisfied clients.

To an installer it means fewer call-backs.

Now here are some of the built-in features that have earned Schemenauer multizone rooftop units a reputation for reliability.

Two heating/cooling systems in one rooftop unit

On our larger units (the most popular sizes) we use two separate cooling systems, two separate heating systems (on gas units). Now that's what we call fail-safe protection!

Under average cooling conditions, only one cooling system operates. In extremely hot weather, both systems operate. And, if one system should become inoperative for any reason, the other will continue to operate so that occupants would never be without cooling.

Dual gas heating systems give the same fail-safe protection. Either one supplies enough heat, even in sub-zero weather, to prevent freeze-up in any of the zones served.

Save up to 50% in operating cost

The dual cooling system means that we use two half-size compressors instead of one large one. So under average cooling conditions, only one is operating—at half the electric power consumption (compared to a single compressor with cylinder unloading which decreases the power consumption approximately 25%). Because a smaller compressor runs for longer time periods than a large one, even more power is saved because there are less frequent motor start-ups.

On the dual heating system, automatic controls modulate gas input down to 20% depending on comfort requirements. As a result, only enough heat is produced to supply the need. Fuel dollars aren't wasted.

We make use of "free heat"

While the Schemenauer unit is cooling some zones, other zones might need heating. That's when we take advantage of the "free heat" in the hot refrigerant coil. By diverting a portion of the cooled, dehumidified, filtered air through that hot coil, we use the heat that is normally wasted. So you get a mixture of cooled air and "free" heated air to meet varied requirements of each thermostatically controlled zone. You don't even have to operate the unit's heating system until temperatures go below sixty degrees.

Positive-acting multizone dampers control comfort accurately

Oversize dampers eliminate damper "position hunting" which can cause wide temperature variations within zones. The air supply for up to 12 zones is handled quickly and accurately by our full-

modulating, 45-degree proportioning-type dampers. The result is better control over both heating and cooling.

Designed with service in mind

Schemenauer rooftop units are designed to 1) eliminate potential service problems, 2) make service easier if it should be necessary and 3) eliminate a possible panic situation by providing back-up systems (in our larger rooftop units) for both heating and cooling.

Like any equipment exposed to weather, a rooftop unit needs weather protection. Protection like our one-piece fiberglass roof. It can't leak. Like double-walled aluminum side panels with a baked enamel finish that can't rust. And like protected panel insulation that can't tear.

Our kind of protection includes special fasteners that bolt and seal the side panels to sturdy aluminum posts. And, weather-tight gaskets that join the rooftop unit to its curb base.

These Schemenauer innovations make our rooftops almost service free. But, like all mechanical equipment, some routine service is necessary and we have that in mind, too.

Most filters, for example, are accessible from either side of the unit. Pilots on gas-fired units are the automatic electric type. Components such as furnaces and compressors are half the usual size and weight (there are two of each on large units), making them much easier to handle.

Small access side panels slip out easily and the aluminum upright panel dividers can be removed without cutting or welding. A remote monitoring panel identifies and locates mechanical problems and this saves costly troubleshooting time. We've even labeled the major compartments to make the serviceman's job easier and faster.

There's a lot more to tell you about Schemenauer multizone rooftop units. They're the units designed to last as long as the buildings they're installed on. Just clip and mail the coupon.

Tell me more about reliable Schemenauer rooftop units for
___ gas ___ electric ___ steam ___ hot water applications.

Have your representative arrange for an appointment.

RT-14467

NAME _____

TITLE _____ FIRM _____

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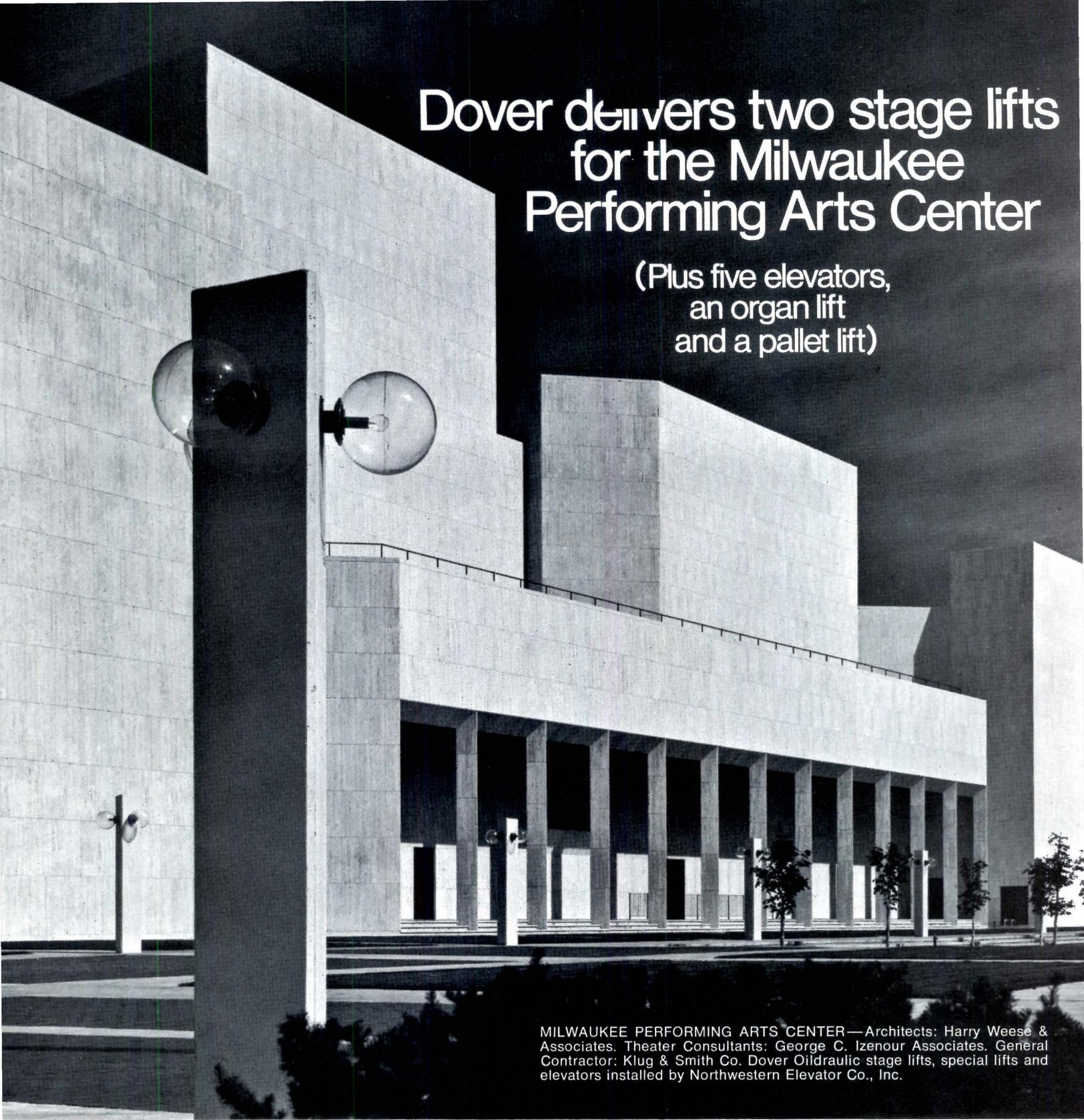


MODINE

**Nothing quite equals Modine/Schemenauer
heating and air conditioning quality.**

Dover delivers two stage lifts for the Milwaukee Performing Arts Center

(Plus five elevators,
an organ lift
and a pallet lift)



MILWAUKEE PERFORMING ARTS CENTER—Architects: Harry Weese & Associates. Theater Consultants: George C. Izenour Associates. General Contractor: Klug & Smith Co. Dover Oildraulic stage lifts, special lifts and elevators installed by Northwestern Elevator Co., Inc.

Another major performing arts complex uses Dover stage lifts for more flexible and adaptable space.

Uihlein Hall, dominant element in the Milwaukee Performing Arts Center, was planned to give equal staging facility to theater, symphony or opera. Two Dover lifts at stage front are used to extend the stage, orchestra pit or seating area as required by the type of performance. A third, with a lifting capacity of 26,400 lbs., supports a huge pipe organ at stage level, or lowers it out of sight in a pit at the rear of the stage area.

These special lifts, like the five elevators also installed here, are moved and support-

ed by Dover Oildraulic® cylinders, power units and controllers. Essential requirements of dependable operation and precise leveling are met by the sophisticated use of hydraulic power developed and refined by Dover over the past 40 years.

In planning any theatrical arts building, consult Dover for suggestions on use of Oildraulic lifts for maximum utility and versatility of available space. Our wide experience in stage lift design and construction can be most helpful. Dover Corporation, Elevator Division, Dept. A-12, P. O. Box 2177, Memphis, Tenn. 38102. In Canada: Dover/Turnbull.



News in brief

The Dodge index of architect-engineer designed building contracts declined in September to 252 (1957-59 equals 100) after rebounding to a substantial 293 in August (November, page 35). All types of non-residential buildings showed seasonally adjusted declines, although schools and stores held closest to the August rate. In the months immediately ahead, it is expected that housing will show the biggest gains.

HUD housing experts see a significant increase in 1971 housing starts as a result of more accessible mortgage funds. Seasonally adjusted annual rates of new home applications received and units started under inspection, reached a 10-year record high in September.

Operation Breakthrough has broken ground on its first site, in Sacramento, Calif., where 400 prototype units will go on 44 acres. Single family detached and attached, garden apartments and high rise in all price ranges, will be built by the Aluminum Company of America, Boise-Cascade Corp., Christiana Western Structures, F.C.E.-Dillon, Inc., Material Systems Corp., Pantek Corp., and TRW Systems (April, page 137). A second groundbreaking was at Macon, Ga.

President Nixon intends to nominate William D. Ruckelshaus as Administrator of the Environmental Protection Agency (September, page 35, November, page 35). Mr. Ruckelshaus, now an Assistant Attorney General in the Department of Justice, prosecuted polluters in his former position as Assistant Attorney General in Indiana, where he wrote the state's air pollution control law in 1963. He served in 1966-69 as majority leader in the Indiana Legislature.

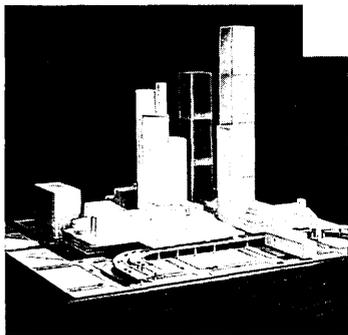
California's housing referendum law is under attack by the National Association of Home Builders and the American Institute of Architects, who have joined the National Urban Coalition in filing a "friend of court" brief asking the U.S. Supreme Court to strike down the law. The state requires a local referendum before low-cost housing can be built. A lower court has already ruled against the law. Similar laws exist in seven other states.

Environment groups are not likely to be hurt by new Internal Revenue Service guidelines, as had been feared. The I.R.S. had announced a study of tax exemption for "public interest law firms" in October, causing consternation when rulings on tax-exempt status were temporarily suspended in environment cases. Conservationists formed an *ad hoc* organization in Washington to defend tax exemption in environment cases, and Russell Train, director of the President's Council on Environmental Quality, supported their views. The study was completed a month early, and the resultant new guidelines ruled that representation of "a broad public interest rather than a private one" was a largely sufficient qualification for tax-exemption.

A shopping center has won an award as the best building of the decade in Dallas, Texas. Northpark Regional Shopping Center, Harrell and Hamilton, architects, Lawrence Halprin and Associates, landscape architects (April, 1966, page 150), has received the newly-created Campbell and Tucker Award for Architectural Excellence. The Dallas Chapter of the A.I.A. administered the award which will be presented annually from now on. The prize, donated by a local real estate firm, will be a \$10,000 sculpture.

Architect Manley L. McGee was defeated last month in his race for the Congressional seat of the 15th Ohio District. Mr. McGee had received support from Senator Muskie, and had asked for backing from architects across the country, arguing that the profession needs a voice in the House.

Nominations for the 1971 fifteenth annual R. S. Reynolds Memorial Award for distinguished architecture with use of aluminum, offering \$25,000 and an original aluminum sculpture, are due February 1, 1971. The A.I.A. administers the awards. **Entries to the Design in Steel Award Program**, sponsored by the American Iron and Steel Institute (New York City) are due January 29, 1971. An international competition will be held for **the design of the new business center of Perugia-Fontivegge, Italy** by the town of Perugia and the Industrie Buitoni Perugina Company. Contact: Comune di Perugia, Segreteria del Concorso Internazionale, Casella Postale no. 235, 06100, Perugia, Italy. **An international competition for the development of the historic center of Ghent, Belgium**, will offer \$20,000 in prizes. Write: Ghent International Fair, "Ghent Tomorrow" Competition, Palais des Floralies, B.9000-Ghent, Belgium. **Submissions to the American Institute of Architects national Honor Awards program for 1971** are due January 15, 1971. **Proposals for the \$10,000 Arnold W. Brunner Scholarship** of the New York Chapter, A.I.A. are due January 4, 1971.



Houston and LA plan major downtown additions

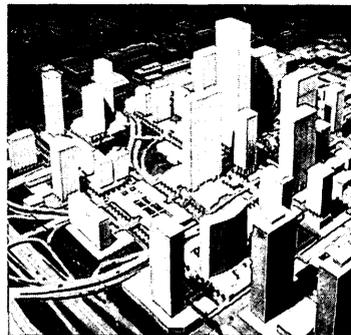
Houston Center, a private development by the Texas Eastern Transmission Corporation, is planned to

be a 74-acre office-recreation-residential-cultural complex, virtually doubling the city's urban core.

The design, by architect-planners William L. Pereira Associates and project managers Brown and Root, Inc., puts all buildings above a four-story garage, allowing uninterrupted movement on foot or on moving sidewalks or "high-speed people-movers," all air-conditioned. A superhighway ring is proposed to surround the second phase.

The first phase (above, left) containing three office towers, a major hotel, stores, a grand plaza, low-rise offices, and terraced apartments, all above the garage, begins construction next year.

Richard K. Koch



New plans for the Bunker Hill Urban Renewal Project (above) in downtown Los Angeles combine a variety of land uses and separation of automobile and pedestrian movement. The billion-dollar project,

planned under the aegis of the city's Community Redevelopment Agency, is to include offices, stores, theaters, hotels, convention facilities and 3,600 units of apartment housing.

Pedestrians are separated from traffic by a series of raised plazas and bridges spanning the main streets. An elevator-escalator system will assist pedestrian movement; the restored Angel's Flight railway, a city landmark, will also do its part. A Los Angeles version of a "people-mover" will transport drivers to and from large garages on the periphery of the project. A hill-top pedestrian concourse will link the project with the nearby Civic Center.

Owings honored at Ball State

Architect Nathaniel A. Owings, 67, one of the founders of the architectural firm of Skidmore, Owings and Merrill, recently received an honorary doctor of laws (LL.D.) degree from Ball State University in Muncie, Indiana, his home state.

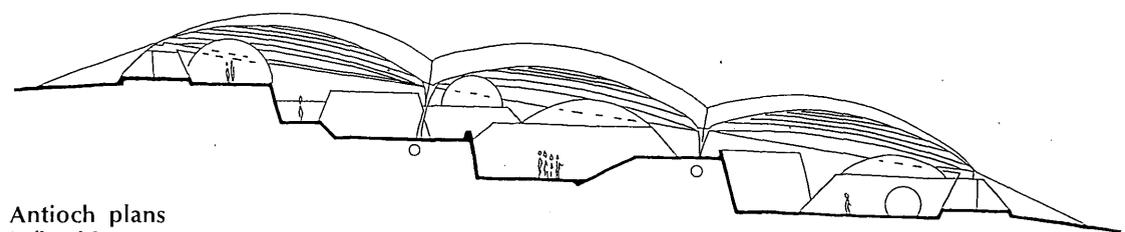
CDC's discuss their problems

The A.I.A. held a one-day seminar on Community Design/Development Centers (CDC) last month, at the Octagon in Washington, D. C. Participants included about 20 CDC directors from around the country, along with officials from HUD, from the Conference of Mayors, from several senatorial staffs, and from the A.I.A.

The topic of the day was "A Means for Community Delivery." It was noted that most of our large-city CDC's have been effective vehicles for articulating community needs within the urban design process, but that delivery is deficient: housing is not built, vacant lots do not become parks, and frustration is thereby only increased.

It was difficult to keep the discussion focused on this crucial problem of delivery; some of the participants thought the conference was less successful than it could have been, because people talked in emotional ways about the evils of "the system," rather than about means of changing the system, using it, or working within it.

One useful outcome was the gradual realization that an operational definition of a CDC is needed: a clear statement of what they do and how, so that direct Federal funding through legislation can be obtained. A tentative agreement was reached that CDC representatives would talk to the next U. S. Conference of Mayors' convention, and state their case. And it was certainly useful for the various isolated CDC directors to get a feeling for problems common to them all.

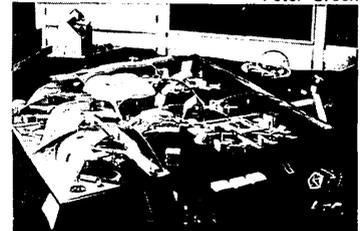


Antioch plans inflatable campus for Columbia, Md.

Antioch College is planning to build an inflatable campus in the downtown section of the new city of Columbia, Md. The "nomadic/pneumatic" campus was designed by the school's environmental studies department under a grant from the Ford Foundation's Educational Facilities Laboratories. It will cover an acre, providing living accommodations for 300 students, classrooms,

offices, theater spaces, and a college green. Metal-coated high-strength plastic laminated to the roof skin will reflect heat; double wall construction will provide insulation. Cost: about \$3.00 per square foot. Princeton University and La Verne College (San Diego) are also planning major membrane structures, La Verne's to cover six to eight acres.

Peter Green



Architects and students complete six-year survey of Nantucket

A University of Florida professor of architecture, F. Blair Reeves, and six students have completed a six-year architectural survey of Nantucket island, off Cape Cod. The Historic American Building Survey, the Department of the Interior, the American Institute of Architects, and the

Jack F. Boucher, HABS



Library of Congress sponsored the project.

Nantucket buildings, some of which are 300 years old, were documented in photographs, measured drawings, plans and written descriptions. A traveling exhibition of the work is available through the Smithsonian Institution.

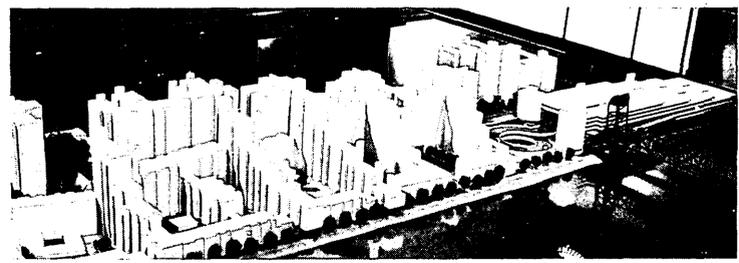


Welfare Island work in progress revealed

The First Interim Report on plans for New York City's Welfare Island is on view in the form of an exhibition at the city's Metropolitan Museum of Art. The state's Urban Development Corporation (October, page 36), is developing the island in the East River opposite midtown Manhattan. Architects Philip Johnson and John Burgee drew up the master plan, announced last year (November,

1969, page 40), the principals of which are: no automobiles; a varied and complete community; full exposure to waterfront and river activities.

The U.D.C. chose leading architectural firms for the island, including Conklin and Rossant (housing), Kallmann & McKinnell (garage and plaza), Sert, Jackson and Associates (housing), Mitchell/Guirgola Associates (housing), Johnson and Burgee (town center), John M. Johansen (housing), Giorgio Cavaglieri (Octagon Ecological Museum). Park designers are Dan Kiley and Partners and Zion & Breen. Engineers Gibbs and Hill, Inc. designed the infrastructure and transportation. Construction will begin next June; the first tenants are due to move in two years later.





N.Y. Daily News, Frank Castoral photos



Mac Gordon

Architect designs temporary "people's park" in Manhattan

"New Earth Park" is an acre on Manhattan's West 50th street which has been turned into a park with a minimum of funds and a maximum of hard work by architect Mac Gordon, residents of the neighborhood,

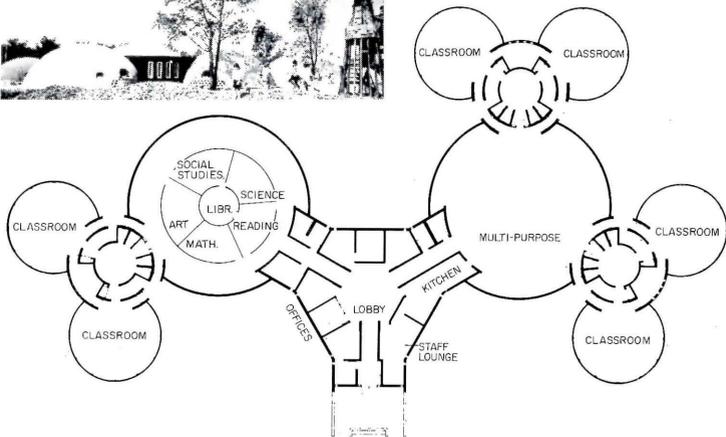
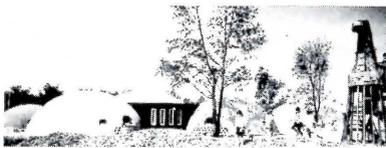
interested high school students, and an environment group called "Environment."

The site, in a depressed area of the city, was levelled six years ago for an urban renewal project now expected to be built in about two years. "Environment" proposed the site for a park and Gordon volun-

teered to plan it. "Then I found I had to build it, too," he says. The community, largely non-unified, joined in as the park got underway.

Construction companies donated tools; a junk man across the street built play towers (right) of electric cable reels; a paved area became a basketball court when

Painted. The city smiled its approval and donated some park equipment, a fence and a path. Debris (left) became a grassy mound (center). The only expense, \$4,000, went for topsoil and sand, paid for by "Environment" and by contributions. Mac Gordon hopes to do more parks next year.



Plastic domes enclose Detroit school

Architects Tarapata-McMahon-Paulsen Associates, Inc., of Detroit, designed the Roeper City and Country School for children aged 4-7 using Dow Chemical's spiral generation technique. In the system, heat-welded planks of foam plastic are built up by a rotating boom. Open-

ings are then cut in the dome, and finishes applied. At the Roeper school, interiors are of acoustic plaster near the top, hard plaster below, exteriors are of reinforced latex modified cement covered by dyed epoxy-silicone waterproofing. The result is a flexible series of spaces well-insulated from the noise of a nearby highway.



Prototype new town to rise north of Chicago

New Century Town, a complete community of about 18,000, will be built 30 miles north of Chicago's Loop as a joint venture of Sears, Roebuck and Co.; Mafco, Inc., a subsidiary of Marshall Field and Co.; and Urban Investment and Development Co., a subsidiary of Aetna

Life and Casualty. It will contain housing for all incomes, using clusters of townhouses, low and high-rise apartments. A multi-level commercial center will conserve space. Llewelyn-Davies Associates are consultants for the design. The sponsors plan to build more new towns around the United States. A prototype model appears above.

HUD announces design award-winners

The Dan Ryan Transit Stations in Chicago (below), Skidmore, Owings & Merrill, consulting architects, were among 30 projects participating in, or financed through programs of the Department of Housing and Urban Development to receive design awards this year. The winners ranged from single buildings (page 30) to large projects in the Urban Design Concept category.



The following urban projects received awards: Detroit 1990, an urban design for the 18 square mile inner city by the Detroit Planning Agency; Jonathan New Town, Chaska, Minnesota (April, page 40), a plan for a new community of 50,000 by the Development Corporation Design Group, Ben H. Cunningham, A.I.A., director; Metro Center 1985, Minneapolis, Minn., a comprehensive outline for the 1,800 acre center of the city by the City Technical Staff; Skyline Project, Denver, Col. (November, page 36), a renewal plan for part of the central area under design consultants Marvin Hatami and Associates and Floyd Tanaka and Associates of Denver; Yerba Buena Center Central Blocks, San Francisco, by Kenzo Tange and Urtec, John S. Bolles Associates, Lawrence Halprin, and Gerald M. McCue; and Reading Downtown East, Reading, Penn., Stonorov and Haws, architects, Collins, Du Tot and Associates, landscape architects.

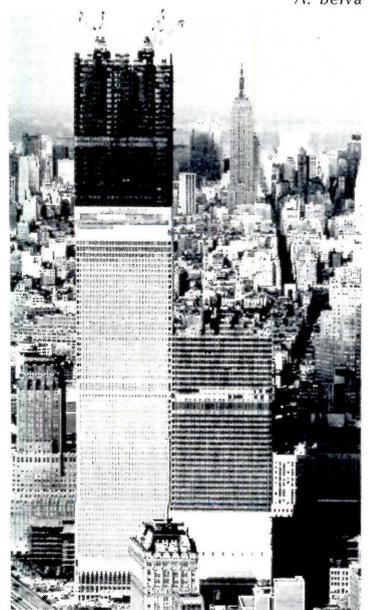
Albert Kahn Associates celebrates 75 years

Albert Kahn Associates, Inc. Architects and Engineers was founded 75 years ago, and they're still going strong in Detroit. Mr. Kahn (1869-1942) was often called the father of industrial architecture; he was among the first to integrate architecture with engineering. The Detroit Institute of Arts ran an extensive exhibition of the firm's current work last month.

World Trade Center becomes the tallest—this year

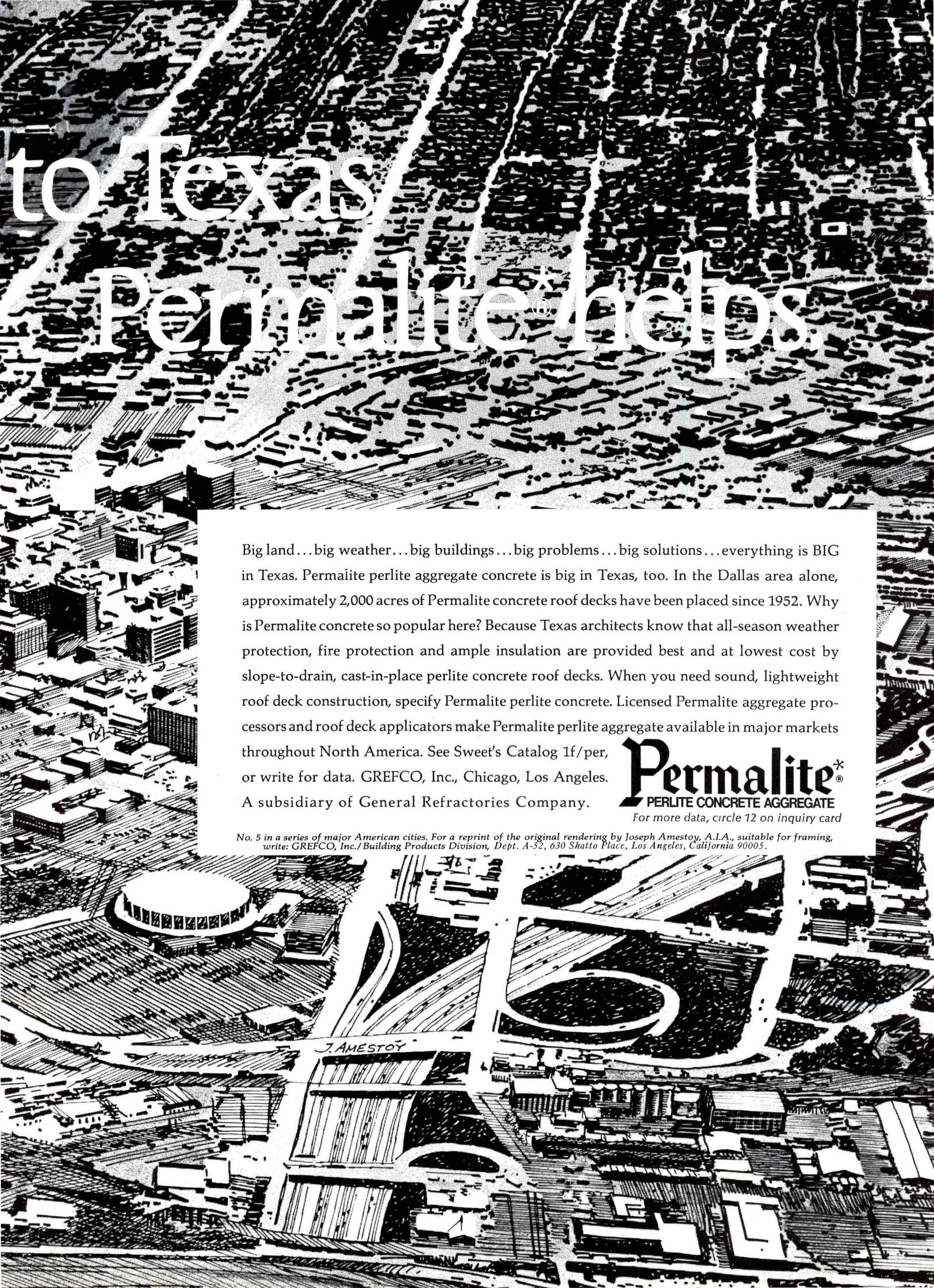
Most New Yorkers didn't notice—they never look up—but a few weeks ago, the North tower of the World Trade Center (Minoru Yamasaki and Associates and Emery Roth and Sons, architects) became the world's tallest building when the first steel-work for the 103rd floor was put in. Its glory will be brief, however, as Chicago's Sears tower (September, page 41) will out-top it in 1974.

A. Belva



Dallas lives up



An aerial architectural rendering of a city, showing a dense grid of buildings and a prominent multi-level highway interchange with several overpasses and ramps. The drawing is done in a detailed, hatched style. The text 'to Texas' is written in a large, white, serif font across the top left, and 'Permalite helps' is written in a similar font across the top right, with a small star above the 'i' in 'helps'.

to Texas Permalite helps

Big land...big weather...big buildings...big problems...big solutions...everything is BIG in Texas. Permalite perlite aggregate concrete is big in Texas, too. In the Dallas area alone, approximately 2,000 acres of Permalite concrete roof decks have been placed since 1952. Why is Permalite concrete so popular here? Because Texas architects know that all-season weather protection, fire protection and ample insulation are provided best and at lowest cost by slope-to-drain, cast-in-place perlite concrete roof decks. When you need sound, lightweight roof deck construction, specify Permalite perlite concrete. Licensed Permalite aggregate processors and roof deck applicators make Permalite perlite aggregate available in major markets throughout North America. See Sweet's Catalog 1f/per, or write for data. GREFCO, Inc., Chicago, Los Angeles. A subsidiary of General Refractories Company.

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No. 5 in a series of major American cities. For a reprint of the original rendering by Joseph Amestoy, A.I.A., suitable for framing, write: GREFCO, Inc./Building Products Division, Dept. A-52, 630 Shatto Place, Los Angeles, California 90005.

J. AMESTOY



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The operating partners of David Nassif Associates explained why they specified "Antron". "Cleaning is the whole game. Carpeting is less costly to maintain than tile.

"We knew there would be no durability problem with nylon, so we were primarily concerned with economically maintaining the appearance level of the carpet. A maintenance saving would enhance our return on investment, so 'Antron' was chosen for its soil-hiding ability.

"We are confident that we made the right decision."

David Nassif Associates believe "Antron" was the right choice for them. It probably is right for the job you're working on now. There is a broad variety of carpet styles in "Antron" now available. Let us know what you're planning. We'll put you in contact with carpet mills that can solve your problems with a carpet of "Antron"



Better things for better living
...through chemistry

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Owner: David Nassif Associates
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Carpet: Pile of 100% Antron[®] nylon
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Universal Engineering Corp., Boston, Mass.
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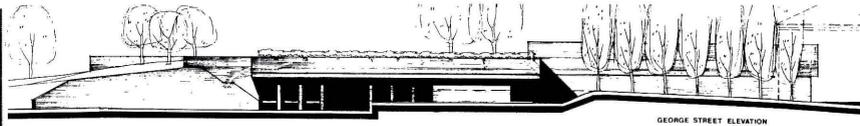
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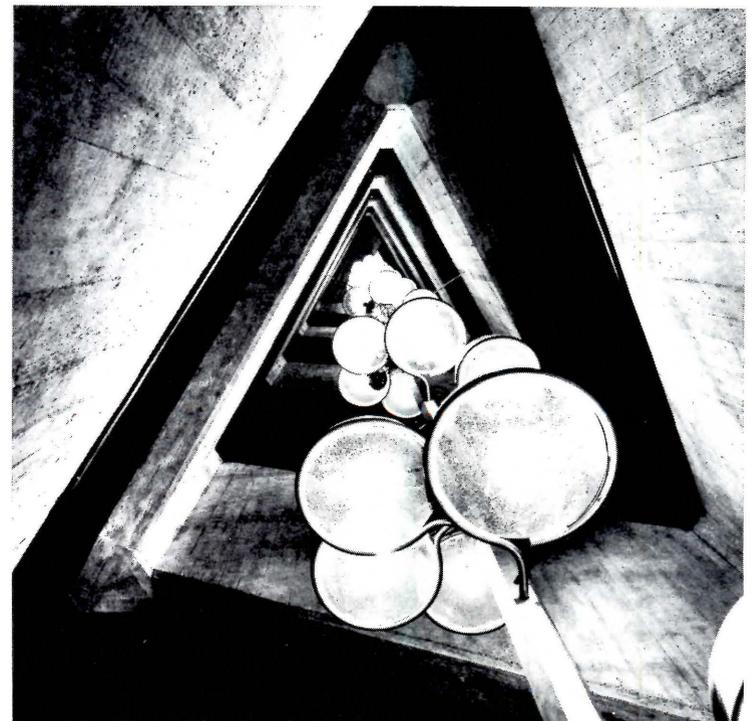
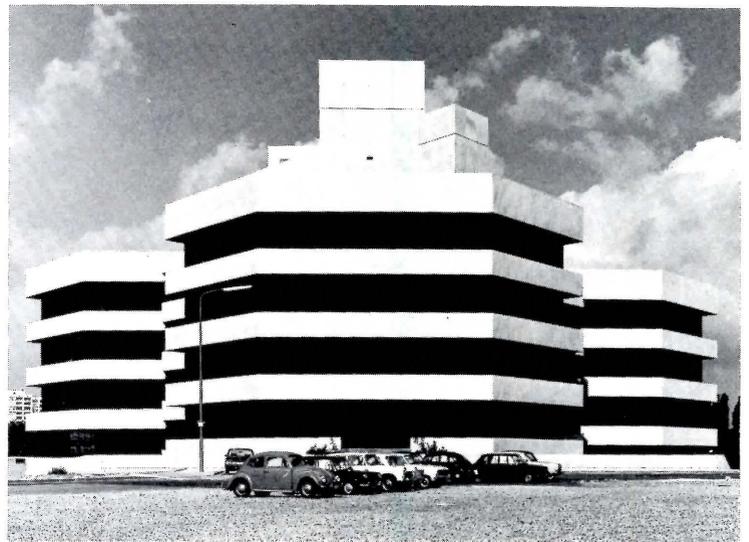
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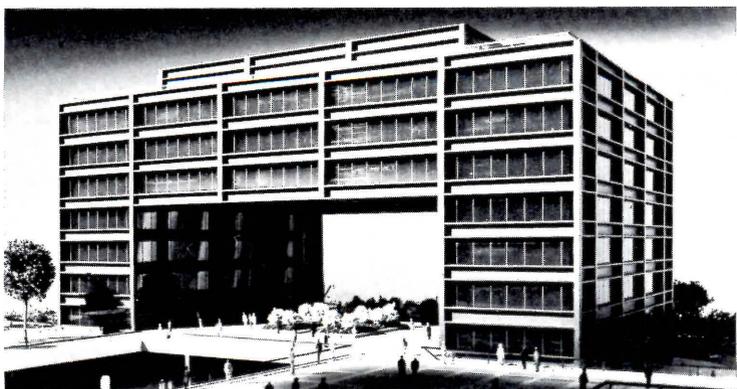
Dining Hall, Douglass College, New Brunswick, New Jersey, Holt & Morgan, architects, was one of nine designs to receive awards for outstanding design from the New Jersey Society of Architects. The building is largely submerged below ground to avoid overpowering the small buildings surrounding it. Roof provides stepped plazas.



City Bank and Office Building, St. Louis, Wedemeyer Cernik Corrubia, Inc., architects, cantilevers upper floors to make the best of a narrow site. Lower facade will be of masonry to blend with neighboring buildings, while upper portions will be of glass and textured concrete.



Rank Xerox GmbH office building, Dusseldorf, Germany, Hentrich and Petschnigg, architects, arranges three hexagonal blocks in a spiral around a central core containing all service and utility lines, as well as elevators. A balcony runs around the window band on each level.

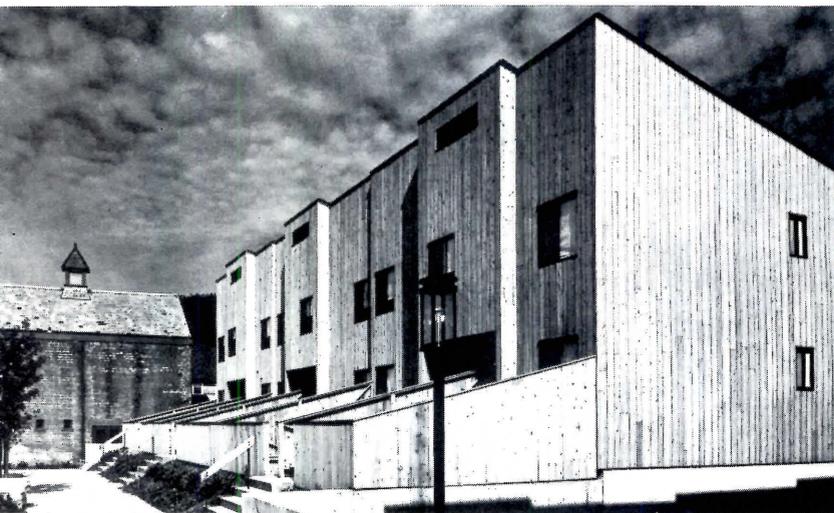


Marine Midland Trust Company of Southern New York, Binghamton, N.Y., Charles Luckman Associates, architects, was designed as a gateway to the new Binghamton Civic center. The shape also reflects varying floor size needs of the bank and individual tenants.

Department of Housing and Urban Development announces design awards

Thirty construction projects from across the country, ranging in size from single buildings to large development programs (page 25) received the Fourth Biennial HUD Design Awards. All award-winners were built under HUD assistance or insurance programs. Individual buildings not shown are: **Acorn Housing**, Oakland, Calif., Burger and Coplans, Inc., architects; **Banneker Homes**, San Francisco, Calif., Joseph Esherick & Associates, architects; **Medgar Evers Memorial Pool**, Seattle, Washington, John M. Morse and Associates, architects. **Crown College Residence Halls**, Santa Cruz, Calif., Ernest J. Kump Associates, architects;

Diamond Heights Housing, San Francisco, Calif., Clement Chen, and Associates, architects; **Homestead Terrace**, Mill Valley, Calif., Worley K. Wong, architect; **Housing for the Elderly**, Wayne, Michigan, William Kessler and Associates, architects; **Nine-G Cooperative**, New York City, Edelman and Salzman, architects; **Northridge House**, Seattle, Washington, McCool-McDonald & Associates, architects; **Santa Venetia Oaks**, Marin County, Calif., Worley K. Wong, architect. A seven-member jury of architects, planners, engineers and urban specialists chose the award-winners from among nearly 300 entries.



Dwight Cooperative Town Houses, New Haven, Conn., Gilbert Switzer and Associates, New Haven, architects, features a three level system of site organization for families comprising 330 residents.

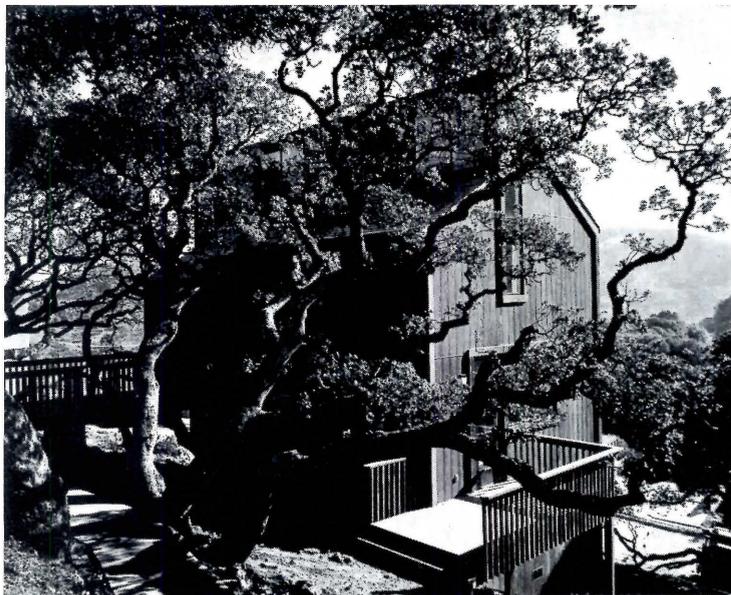


Christopher Columbus School, New Haven, Conn., Davis, Cochran, Miller, Baerman, Noyes, architects,

a K-4 elementary school, was praised by the jury for its efficient plan.



727 Front Avenue, St. Paul, Minn., Freerks, Sperl, Flynn, architects, St. Paul, high-rise apartments of exposed reinforced concrete are oriented to face the two major views from the site.



Marinview, Marin County, Calif., Fisher-Friedman Associates, San Francisco, architects and planning consultants, consists of 300 single-family homes designed to respect the mountainous character of the rural site.

Lower Grassy-trace Branch Community Center, Toulouse, Ky., designed and built by students at the Yale School of Art and Architecture under supervision of the faculty. Designing students were David Shepler, Mark Ellis, Robert Hammel, and Robert Nicholais. The center serves 150 families in a depressed area.



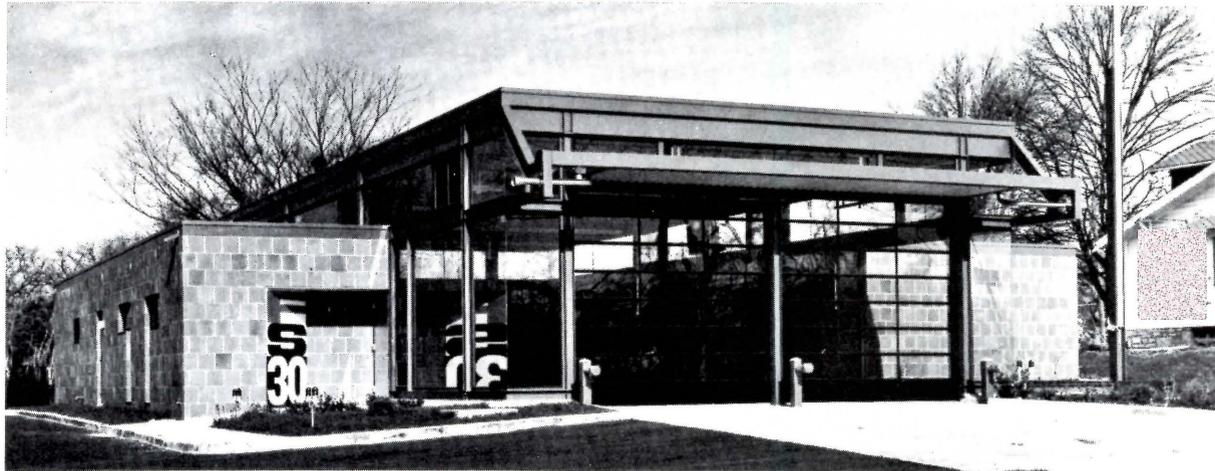
Prototype Pedestrian Information Center, Boston, Mass., Ashley/Myer/Smith, Inc., Cambridge, Mass., architects and planners, was a full-scale temporary working model to demonstrate and test a set of ideas for permanent centers. Eight brightly-colored kiosks topped by 12 foot translucent plastic balloons dispensed eight types of information.

American Institute of Steel Construction presents fourteen awards

Fourteen winners have been named in the Eleventh Annual Competition for steel framed buildings sponsored by the American Institute of Steel Construction. Buildings not shown are: **Temple B'Nai Jeshurun**, Short Hills, N.J., Pietro Belluschi-Gruzen and Partners, associated architects; **GRT Corporate Headquarters Building**, Sunnyvale, Calif., Brown/McCurdy/Nerrie, architects; **Manufacturers Hanover Trust Co. Operations Building**, New York City, Carson, Lundin and Shaw, architects; **Currihan Exhibition Hall, Denver, Colorado**, Muchow, Ream and Larson, architects (see page 81); **Knights' of Columbus Headquarters**, New Haven,

Conn., Kevin Roche John Dinkeloo and Associates, architects (August, page 109); **Hazel Hotchkiss Wightman Tennis Center**, Weston, Mass., Sasaki Dawson, DeMay Associates, architects; **Bank of America World Headquarters**, San Francisco, Wurster, Bernardi and Emmons, Inc., architects (July, page 126); with Skidmore, Owings & Merrill (Chicago) and Pietro Belluschi, consultant (July, page 126); **Frank C. Bishop Library**, Monterey, Calif., Smith Barker Hanssen, architects; **Performing Arts Center**, Milwaukee, Wisconsin, Harry Weese & Associates, Chicago, architects (November, 1969, page 149).

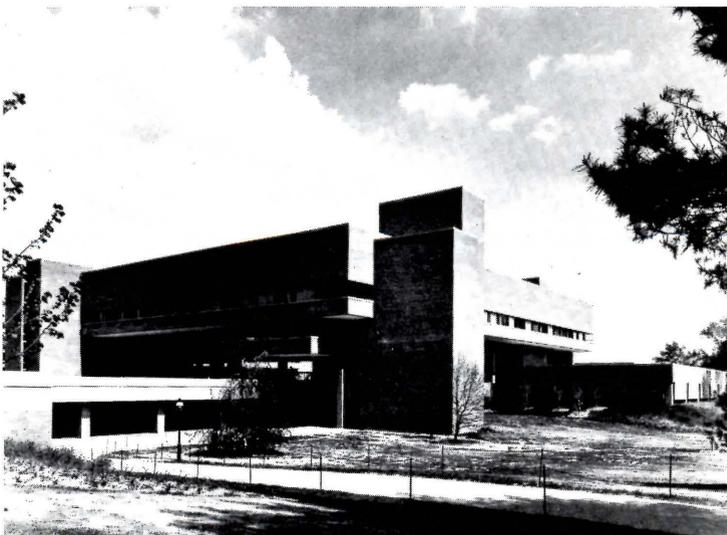
Fire Station Number 30, Kansas City, Mo., Seligson/Eggen, architects, contrasts glass-walled space for fire trucks and other equipment with solid elements for living quarters and service elements.



New England Center for Continuing Education, Durham, N.H., William L. Pereira Associates, architects, contains a hotel-like residential tower for transient seminar participants, a learning center with flexible seminar rooms, a dining hall, and a gallery. Tower, based on a hexagon, was planned to fit among trees. Furniture was custom-designed for the non-rectangular rooms. Two more towers and learning center expansion are planned.

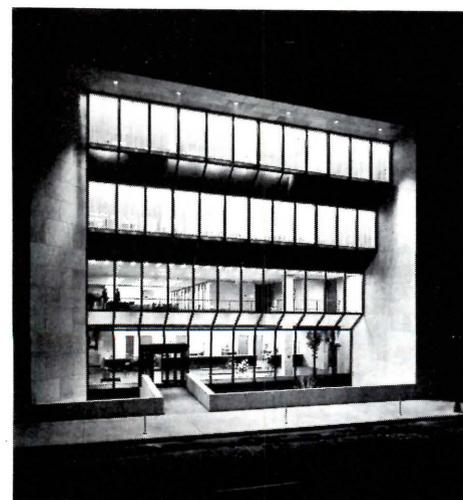


Wellesley Office Park Building Number Four, Wellesley, Mass., Jung/Brannen Associates and Pietro Belluschi, architects, is a prototype to be repeated at the park. Pre-fab structural steel bearing walls with rust-finish are believed the first of their kind. All services are in the core, whose position was chosen according to over-all plan for the Park by the architects.

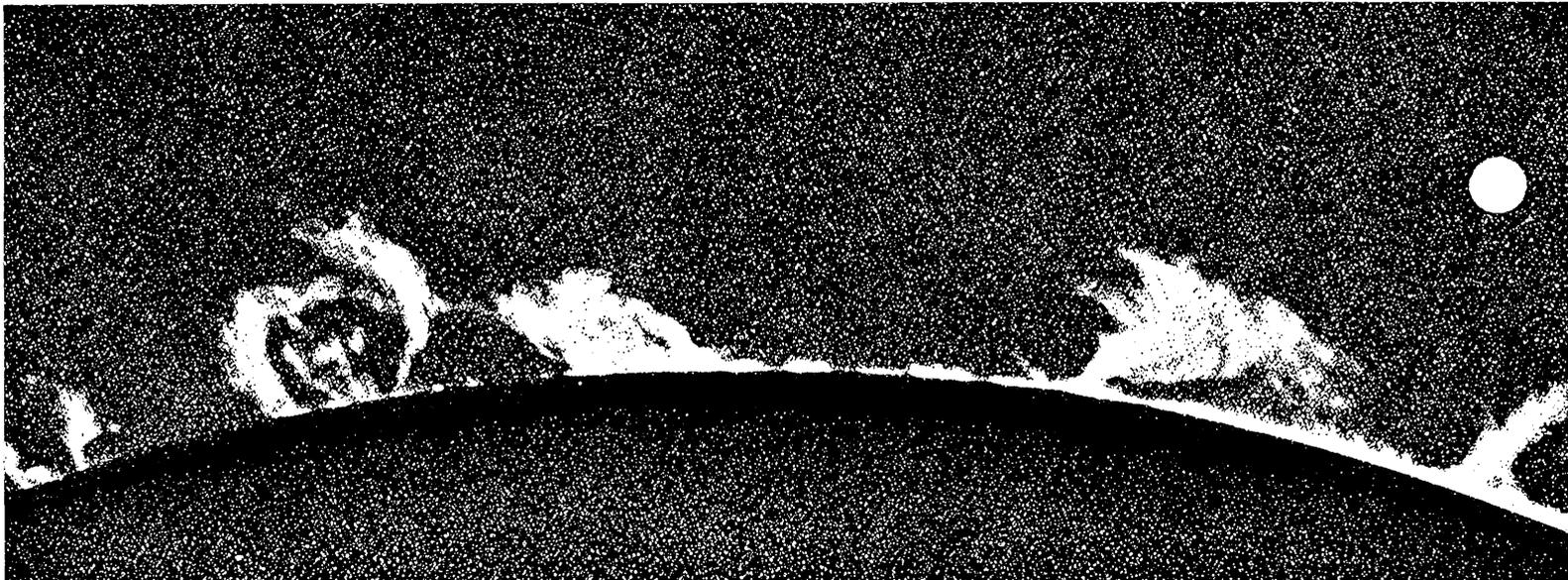


Jadwin Physical Laboratory, Princeton University, Princeton, N.J., Hugh Stubbins and Associates, architects is a focal point for a Mathematics-Physics Complex. Theoreticians face

a central court, experimenters are in a flexible research block; corridors are designed to encourage intercommunication. Materials match neighboring structures.



Farm Credit Banks of Spokane, Spokane, Washington, Walker/McGough/Foltz, architects, contains three specialized banks whose various space needs are reflected in the stepped exterior. Shared functions are in lower floors; stairs, elevators and utilities are in cast concrete sides, supporting clear spans of steel; sunken garden in front.



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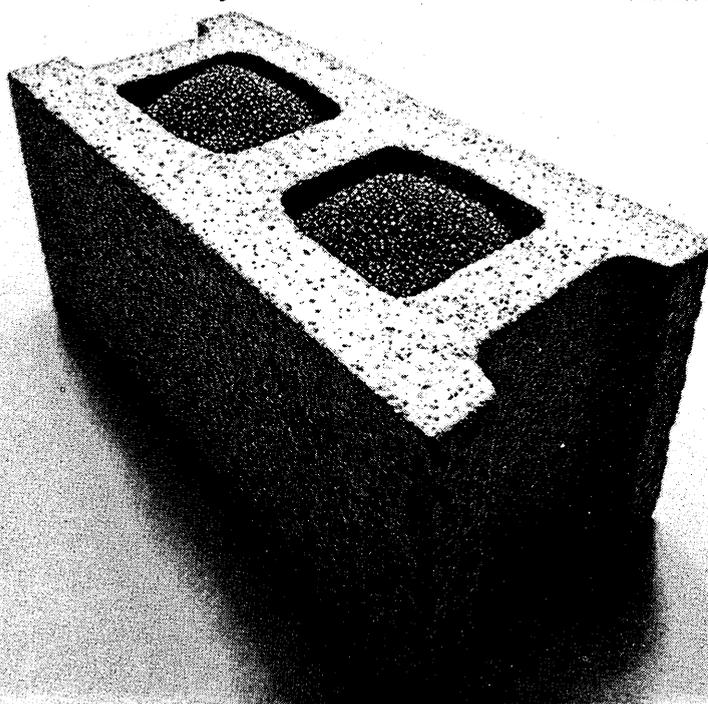
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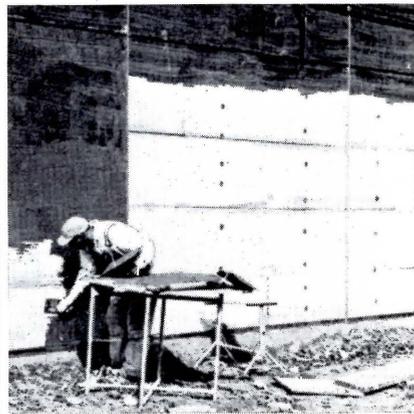
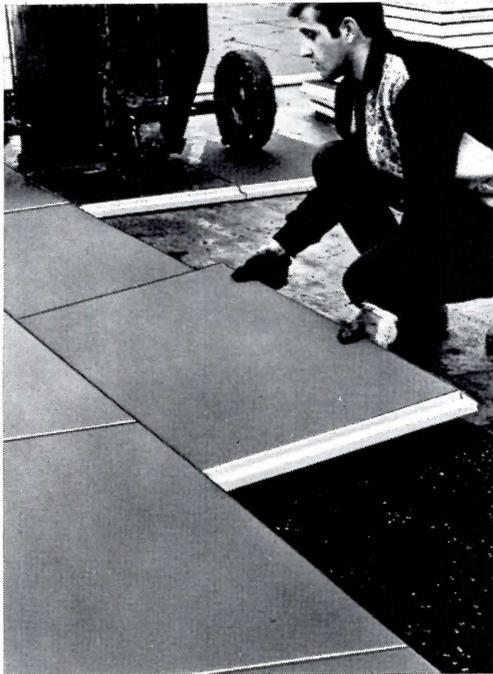
Wall Thickness, Inches	Type of Block	Block Only	
		Uninsulated	Insulated
6	Lightweight	.40	.26
	Heavyweight	.33	.17
8	Lightweight	.53	.36
	Heavyweight	.33	.12
12	Lightweight	.46	.25
	Heavyweight		

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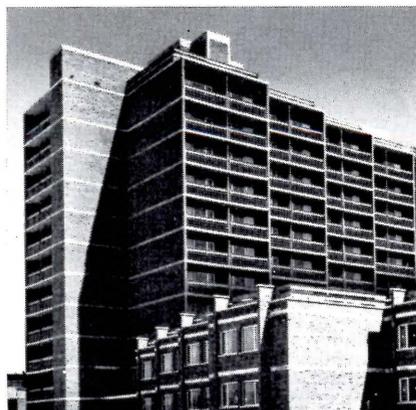


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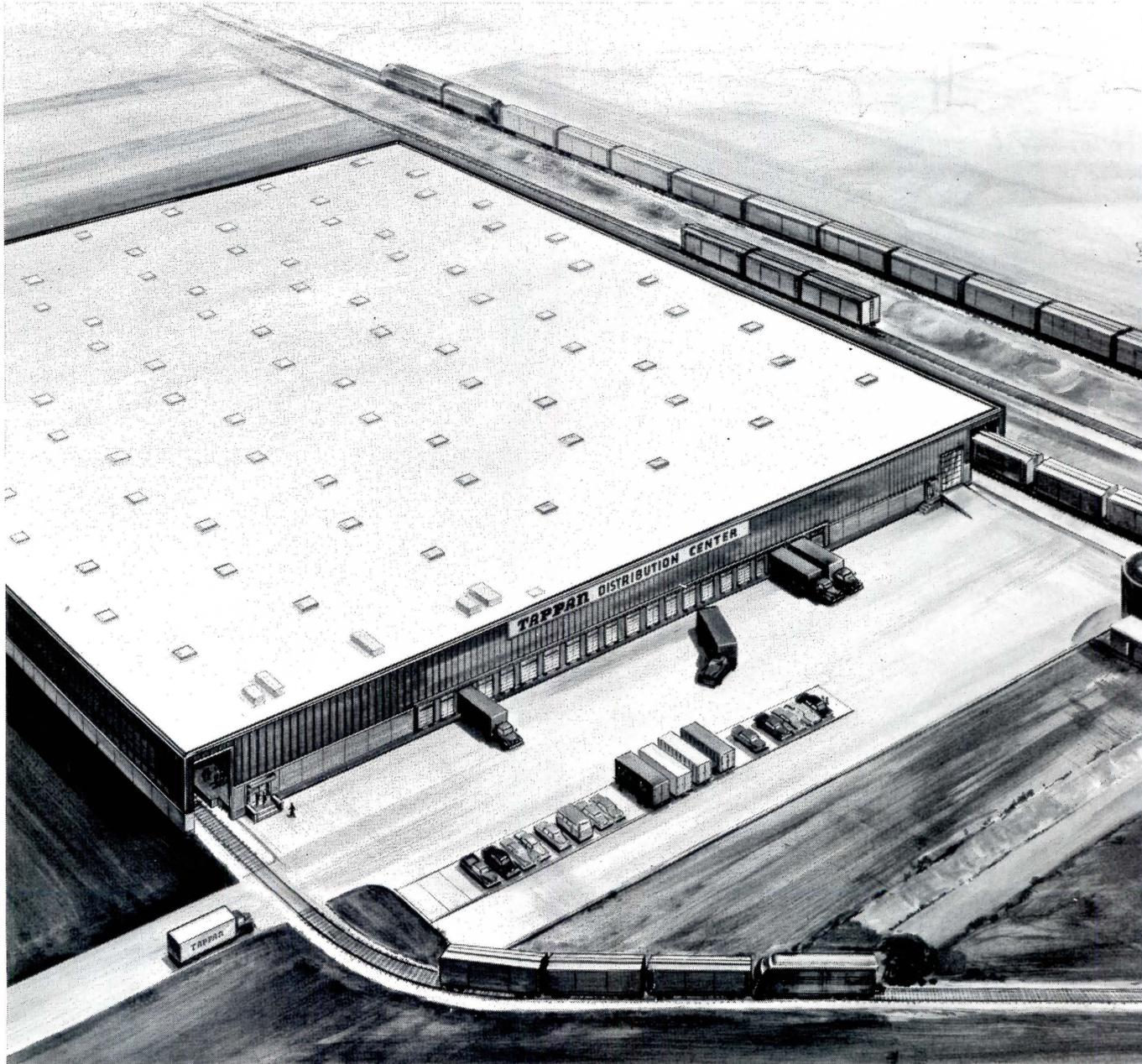
Tappan begins 240-acre expansion with

The Tappan Company has placed a full vote of confidence in its own future by beginning construction on a 240-acre site located in the village of Ontario, Ohio, just west of Mansfield.

Tappan, leading manufacturer of the full line of kitchen appliances and cabinets, also placed a vote of confidence in Macomber Incorporated by employing Macomber steel framing and decking in the first building on the site, a 300,000-square-foot distribution center.

"The Macomber Modified V-LOK System gave us just what we asked for," says Douglas Brunk, facilities engineer for Tappan. "We needed 25 feet of clear height to allow for high stacking of our products. Macomber's open-web steel joists allowed passage of

Tappan's new distribution center, Ontario, Ohio.



Macomber Modified V-LOK[®] System

all ducts, conduits and wiring through the ceiling sandwich, leaving the interior clear. Otherwise, we would have had to go to the considerable expense of adding square feet."

Although Tappan is best known for its gas and electric ranges, both built-in and free-standing, the Tappan line also includes dishwashers, refrigerators, disposers, vent hoods, central vacuum systems and small kitchen appliances.

Mr. Brunk is enthusiastic about the new complex projected for his company. "We bought the whole 240 acres for our own future expansion," he says. "We moved one million yards of earth to prepare the site. We'll probably build a manufacturing facility there next."

Kokosing Construction Co., Inc., served as both designer and general contractor on the Tappan distribution center. President William B. Burgett explains why he chose Macomber products: "The Macomber Modified V-LOK System allowed us flexibility of design and simplicity of erection. The V-LOK connectors on the open-web members provided fast erection and accuracy in overall dimensions.

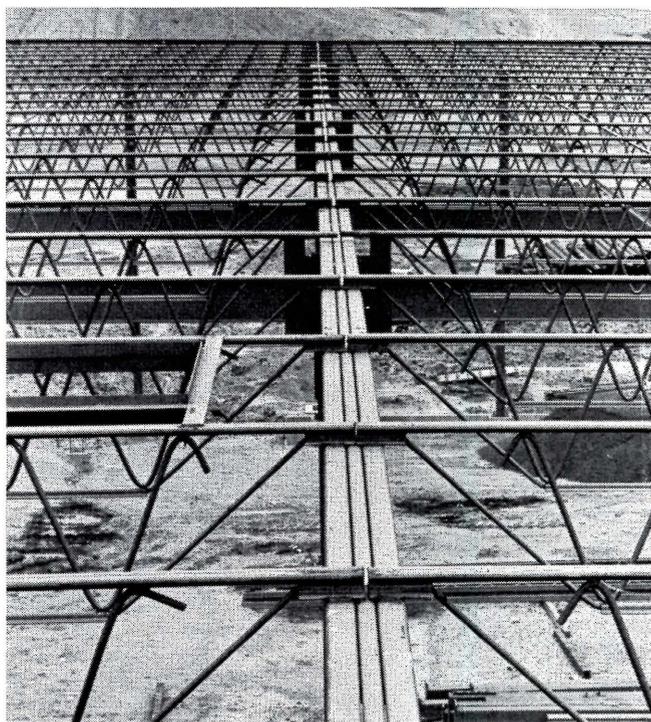
"Macomber's fabricating capacity was another important consideration. It's unusual for one supplier to take on total responsibility for all the steel for a job of this size, but Macomber was able to give us fast delivery on framing and decking. On top of all that, the price was very competitive.

"I've been working with Macomber V-LOK systems for 15 years," Mr. Burgett concludes. "It's been a very happy relationship."

Quality, flexibility, service, speed of erection and overall economy are the reasons why Tappan and Kokosing Construction Co. chose Macomber. If these reasons are good enough for you, call your nearest Macomber representative. For your copy of Macomber's V-LOK Design Manual, write to Macomber Incorporated, P.O. Box 8830, Canton, Ohio 44709.



Macomber V-LOK connectors at the column lines . . .



. . . facilitate true alignment of girders and purlins.



Open-web construction allows passage of pipes, conduits and ducts through the ceiling sandwich, leaving stacking area free of obstructions.

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LETTERS

Please refer to page 137 of your ARCHITECTURAL RECORD, October 1970 issue.

I cannot help but feel refreshed as well as amused in being indirectly classified as a "non-architect" after decades of a productive practice. Not so much to correct the appellative, but in order to correctly state the facts related to the subject of the Pix Theater in White Plains, New York, I wish to submit the following:

1. This project was conceived, designed and built in 1933-1934 by the firm of Bianculli & Ghiani, Architects, of New York City (dissolved in 1935 because of my appointment as design architect with the Tennessee Valley Authority).

2. This project was designed as one of the very first demountable and largely prefabricated structures, when the word "prefabrication" was not yet a part of our ordinary language. The purpose of the building was to serve as a "prototype" for a neighborhood movie house seating about 300, to be built on one of the then called "Taxpayer" lots, and to be amortized in five years. I understand the public acceptance of this movie house in White Plains has been so great, that the structure is still in use after 35 years, with some small enlargements having been added to it.

3. This building was considered strictly "functional," to use a word that is now

commonplace and, for a movie theater, that was quite a shock way back then. The city fathers of White Plains, at that time a half timber pseudo-tudor community, quite reasonably were much alarmed about this intrusion in their midst, but very commendably didn't abuse the writer when he appeared before them to argue the appeal for the building permit (eventually this was granted). So now it could be claimed that the Pix Theater was in a small way the precursor and the pioneer of a great number of creditable projects, built in White Plains during these last 35 years.

4. And finally, if you should care to verify the above, please refer to the Architectural Forum, October 1936, page 374-B, and also to the "Motion Picture Herald," July 27, 1935, pages 7, 8 and 21 ("A Radical Experiment in Theater Operation"), and January 11, 1936, pages 7, 8, and 9 ("An Experiment in Theater Planning and Operation"), where you will find this non-architect's designed building amply publicized.

And now, doggone it, back to my (non?) architectural practice.

Mario Bianculli, A.I.A.
Bianculli & Tyler, Architects, Inc.
Chattanooga, Tennessee

I have just completed reading your October issue. It was so informative and interesting

that I read it from cover to cover—the first time in many years for any of our professional publications.

Thanks for the tremendous amount of work that must have been required to produce such a high quality work.

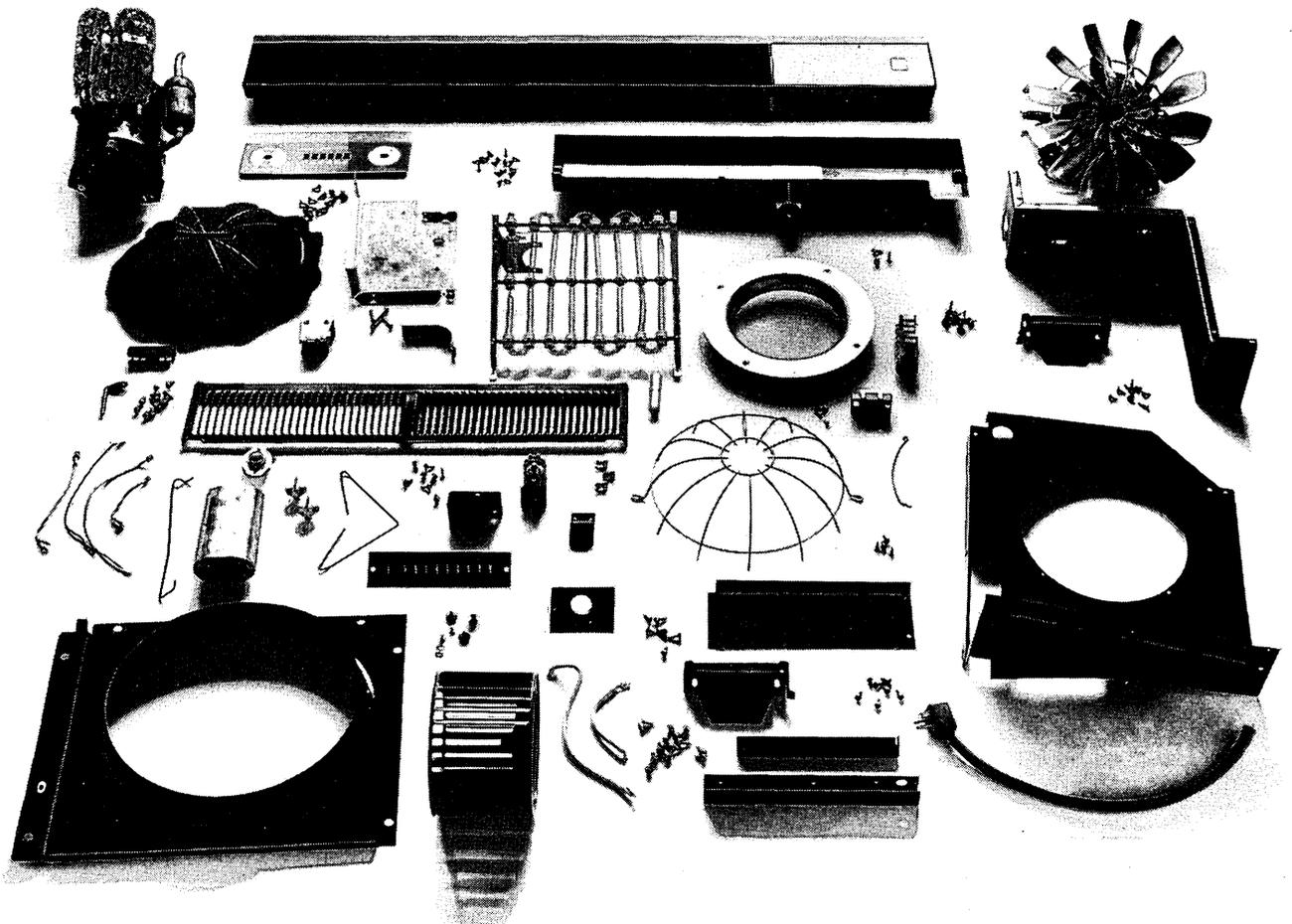
Jesse M. Page, A.I.A.
Jesse M. Page & Associates, Architects, Inc.
Raleigh, North Carolina

Your October issue was first-rate and certainly hit the mark.

The article, "Architects design for a new client: the poor," was particularly interesting to me. However, it is so discouraging to finally realize, as I have here in Baltimore, that while CDC's are an extremely valid and necessary activity, very little money is available to assist the various CDC's in the country. To be sure there are some successes, but until this activity is funded by Ford or by some of the other programs from the Federal level, without strings attached to their grants, I believe Jim Reed is correct that there is very little pie to cut up.

There is much food for thought in your entire issue and I know that it will have a tremendous impact on the architectural profession as a whole. The time is truly here when architects must begin to cooperate with other architects, lobby when neces-

We made a few changes



sary at the state level, get together and discuss matters which are of professional interest to all without harboring fears that they will be giving away secrets to their colleagues. After all, how many times do we all have to discover the wheel?

Congratulations for a splendid job.

*George E. Kostritsky, A.I.A., A.I.P.
RTKL Inc.
Baltimore, Maryland*

I think that the October issue is extraordinarily good. The depth and objectivity of reporting are highly unusual. The material on systems building was a very good example of this, but everything was so good it's hard to pick out any single story. Also, the graphics on the cover were particularly effective.

Thanks for the story on our work which, as you can imagine, I enjoyed as much as anything else.

*Herbert McLaughlin, A.I.A.
Kaplan and McLaughlin
San Francisco, California*

The trouble with systems is not the systems but the architects who talk about them and don't use them.

I'd have to agree with some of your specific observations on Toronto's SEF school, but question if you've chosen a very good project for analysis.

For example, there was no real reason for the exterior skin to have been a part of the system as it was not at all necessary for the skin to constitute a constraint.

The larger question is, will the architectural profession be concerned enough about time, cost and quality control to utilize systems to the degree that a sufficient number of systems and components will be made available? Will the profession display good sense and logic by making creative and relevant uses of the systems we already have so that we'll be given sufficient components for greater variety in appearance as well as functional capabilities?

*George T. Heery, A.I.A.
Heery & Heery
New York City*

We at Smith, Hinchman & Grylls are very proud of the story you did about the Surge Complex and the UTAP program.

*Philip J. Meathe, F.A.I.A.
Smith, Hinchman & Grylls Assocs., Inc.
Detroit, Michigan*

We would like to thank you for the way you included our computer efforts in your October, 1970, article.

Several of the programs which were in the works during your visit have been completed and are in use . . . they do jobs in

minutes that would take days, jobs that no one likes to do, such as room schedules, door schedules, first sheet layouts, etc.

Our space allocation program, the one you used in your article, has been refined to confine the spaces within any shaped rectangle.

Our electrical feeder system has been expanded to apply the feeders to actual building layouts.

In general, we are spending our computer time refining and using what we already have.

*E. W. Sherman
Dalton-Dalton-Little
Cleveland, Ohio*

Liked very much your short, snappy report on the CDC movement. It is crisp, easy to read and has a refreshing lack of verbose detours.

*J. B. Fraser
The American Institute of Architects
Washington, D.C.*

We have just received copies of the October issue and it is causing quite a stir in our office. It appears to be one of the most significant recent issues on the current situation in architecture.

*L. David Godbey, Associate
Golemon & Rolfe, Architects
Houston, Texas*

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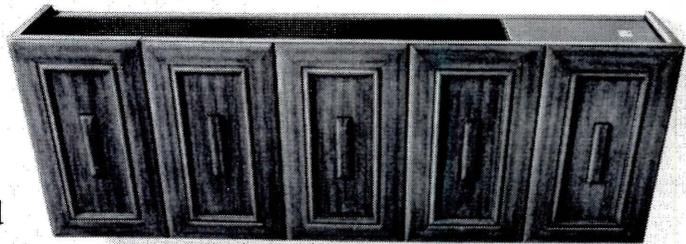
The new Zonline is more rugged! We're using heavier gauge metal in the outer case. The air/water seal has been laboratory tested in winds up to 75 miles per hour and the equivalent of 8 inches of rain per hour. This is rugged, heavy-duty commercial equipment built to withstand constant year-round usage.

And the new Zonline is beautiful!

Inside and out. From an exterior grille that can be integrated into the building design to the new optional simulated molded wood-grain finish of the interior cabinet, Zonline is new and good-looking. All controls are concealed under a door on top where they are easily reached.

If you're looking for terminal thru-the-wall heating/cooling units, see the new Zonline for office, hotel/motel, apartment, school or hospital. Available in deluxe and standard models for 208 V., 230 V., and 277 V., and a variety of installations. See your General Electric Central Air Conditioning distributor right away. Or write the Air Conditioning Dept., Commercial & Industrial Sales Section, Louisville, Kentucky 40225.

For more data, circle 19 on inquiry card

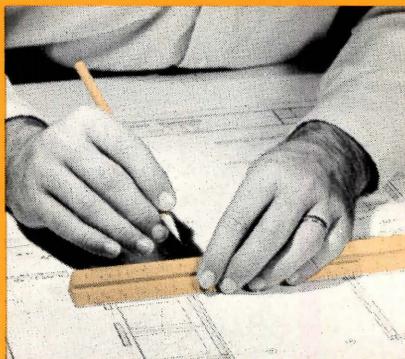


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Let's clear up laws on copyright of plans

By John Warren Giles, attorney, Washington, D.C.

Although not mentioned expressly as a separate category in the statutes, architectural plans, drawings and models are clearly copyrightable under the present copyright laws under the specified class of "drawings or plastic works of a scientific or technical nature." This is recognized by regulations promulgated by the Copyright Office which has, in fact, made many registrations of copyright claims of architectural plans.

The basic difference between a common law copyright and a statutory copyright is that a common law copyright exists solely in unpublished works. Statutory copyright (with certain specific exceptions) exists only in published works. Common law copyright protection is automatically accorded to all unpublished works from the moment of their creation. The mere act of publication (submission for bids) will not automatically grant statutory protection to a work; there must be, in addition, strict compliance with the statutory formalities. Common law copyright protection is perpetual. Statutory copyright is for a term of years. Common law copyright is regulated by the several states. Statutory copyright is solely a matter for the Federal Government.

If someone infringes your copyrighted plans, he may be enjoined from the making or sale of the infringing plans and his copies may be destroyed, and he may be compelled to pay damages to you, the copyright owner. These damages include the damages you have suffered, as well as any profits the infringer may have made as the result of the infringement. In lieu of these actual damages and profits, the court may assess certain statutory damages. This amount is not less than \$250 or more than \$5,000. In addition, there are criminal penalties provided for infringement. An infringer may be liable for imprisonment up to one year and a fine of \$1,000. This same fine may be levied against anyone who fraudulently inserts a copyright notice on plans which are not copyrighted or who fraudulently removes a copyright notice from a copyrighted work.

If someone infringes your copyrighted plans, how soon must you take action against him? You should institute your action as promptly as possible but you must

bring the action within a three-year period. However, you are expected to take all reasonable steps to minimize any loss you may suffer. The best rule is to act immediately."

Once you get your plans copyrighted, the copyright is good for 28 years and may be renewed within the year just prior to the 28th anniversary of the date of first publication. This renewal period is also for 28 years, but you must file your renewal or the work then falls into the public domain.

You do not have to register your plans when you publish them, but in order to be protected by copyright, the plans must contain the correct notice of copyright in the proper position. But unless the copyright is registered, you cannot go into court and

SUMMARY

When a technical or scientific drawing or plan of an architect is registered as such, the copyright proprietor is given the exclusive right to print, reprint, publish, copy and sell his copyrighted work. If these registered plans are copied, an infringement occurs. Whether this copyright protection extends to prevent the building or construction of the object or structure described in the copyrighted plans or drawings is not perfectly clear. Some cases hold that there is no infringement when the architectural plan is merely "used" to construct a building, while other cases have suggested by way of dictum that a use of a copyrighted architectural plan should be considered an infringement, even though the plan itself is not copied into another plan.

It seems that when a copyrighted work is a "model or design for a work of art" the copyright owner is additionally given "the exclusive right to complete, execute and finish it." The result is that when a plan or drawing is registered as a work of art, the architect is also protected against another person's completion or execution of his copyrighted work. However, this type of registration is not easy to effect, and the category is subject to interpretation of the courts.

protect your rights against infringement. You cannot renew a copyright unless you secure an original registration.

In the event that you do copyright your plans, you can protect yourself, and you should, by inserting the required copyright notice on the plans prior to filing them with any building department. It is no hardship to do this, and there is really no excuse for failure to have a copyright notice on your plans. This copyright notice serves as a warning to the public that the plans are protected by copyright, and such notice prevents innocent persons from being guilty of copying a set of plans which are claimed by the owner to be protected by his copyright. The copyright notice serves the further purpose of informing the public of the date of first publication, which in turn determines the duration and extent of the monopoly granted by the statute to the proprietor of the copyright. The case law indicates that the publication of plans with notice of copyright is the essence of compliance with the copyright statute, and publication of the plans without such notice amounts to a dedication to the public sufficient to defeat all subsequent efforts at copyright protection. *Sieff vs. Continental Auto Supply, D. C. 39 Fed. Supp. 683.*

Copyright of plans is not an exclusive right to build

You should remember that the protection extended by Congress to the proprietor of a copyright in architectural plans does not encompass the protection of the buildings or structures themselves, but is limited only to the plans. The Copyright Act is silent on this point. However, it appears to be the unanimous view of respected text writers that under the current copyright laws of the United States, the architect does not have the exclusive right to build structures embodied in his technical writings. Ball, in his work on copyrights, says that a close analogy exists between an "architectural work of art" and a case involving a copyrighted catalogue containing illustrations of dresses, in which it was held that the protection did not prevent the copying of dresses and did not even prohibit their illustration in another catalogue after they had been copied. *National Cloak and Suit Co. vs. Standard Mail Order Co. 191 Fed. 528.* This interpretation as applied to architect's plans would permit the copying of a constructed building and the subsequent use of plans which might closely resemble the originals. Pro-

tection would be limited to the unauthorized copying or use by another of the original plans themselves. In the case of *May vs. Bray* (30 Copyright Office Bulletin 435), the court permanently enjoined the defendant's printing, copying, use or imitation of the plaintiff's copyrighted architectural blueprints for a certain type of ranch house. The court held that the plaintiff's copyrighted plans had been infringed by the use by the defendants of the drawings, and that the defendant had constructed houses in a tract, which were so similar in appearance to the plaintiff's copyrighted plans as to mislead the public into thinking that they were genuine houses of the plaintiff.

This view is further substantiated by a study published by the United States Copyright Office where, in summary, it is stated that copyrighted architectural plans are not now protected against their use in building a structure with the possible exception of a structure which would qualify as a work of art. Various revision bills introduced in Congress between 1924 and 1940 contained provision for the extension of the protection afforded to architects, but so far none of these bills has been enacted by Congress.

You may need a patent instead of a copyright

What are the rights of the parties where the structure is copied from a plan? In *Miller vs. Triborough Bridge Authority*, D. C. N.Y. 43 Fed. Supp. 298, it was held that the design, plan, construction and operation of the approach to the defendant's bridge did not infringe the plaintiff's copyrighted drawings "of a scientific or technical character" which depicted a "novel bridge approach", originated by the plaintiff "to unsnarl traffic congestion". The system of ramps, viaducts, loops, and traffic lanes, jointly described as a traffic separator, comprising the approach, took care of the traffic at the Rockaway Beach end of the bridge, so that all lanes of traffic could move without crossing or being interrupted by other lanes of traffic at that point. The court first found that although the plaintiff's drawings and the design of the defendant's bridge approach were similar, the defendant had not actually appropriated any part of the plaintiff's copyrighted work, saying that the design for the defendant's bridge approach was independently conceived and executed by the defendant's engineers.

The court said, however, that even if it were assumed that the defendant actually used the plaintiff's copyrighted drawing in designing and constructing the bridge approach, the plaintiff would nevertheless be without any remedy, under the principle of the cases deciding that a copyright does not protect against use of the system, method of operation, invention, discovery, or idea described in a copyright work. Thus in this case, the court said that the plaintiff's copyright did not prevent anyone from using and applying the system of traffic separation set forth in the drawing. Accordingly, the complaint was dismissed. The whole point

of the opinion here was that the only way the plaintiff could secure adequate protection to the art which he sought to protect was to obtain a patent, rather than a copyright. The court based its view on *Baker vs. Sullivan* 101 U.S. 99, wherein the court held that a claim to the exclusive property in a peculiar system of bookkeeping cannot be maintained under the law of copyright by the author of a work in which the system is exhibited and explained. The Supreme Court said that protection was the function of letters patent, not copyright. The claim to an invention or discovery of an art or manufacture must be subject to the examination of the patent office before an exclusive right can be obtained and it can only be secured by a patent from the government.

In 1962 in *De Silva Construction Corp. vs. Herald* (1962 D.C. Fla. 213 Fed. Supp. 184) it was recognized that the protection which is extended to the proprietor of a copyright in architectural plans is limited to the plans themselves and (with the possible exception of a structure which would qualify as a work of art) does not give the architect the exclusive right to build the buildings or structures embodied in the plans. The court pointed out that a building is not a copy of the plans for the building, and that to build a structure from the copyrighted architectural plans is not an infringement of the plans themselves. The court further stated that the law is clearly contrary to the position that an architect who has copyrighted his plans is entitled to the same protection as authors of musical compositions and dramatic works who have copyrighted their works.

In commenting upon the case of *Muller vs. Triborough Bridge Authority* mentioned earlier, the court said that the underlying rationale of that case seemed to be that a copyright on a drawing or a picture of a nonartistic object of utility does not preclude others from making the three-dimensional object portrayed in the drawing or picture. The court observed that the situation was analogous to the trade catalogue cases deciding that the copyright in the picture of a product is not infringed by making the product depicted. The court further said that it could not read into the copyright laws something which was not there; and that until Congress should decide to extend the protection afforded to architects, there was no basis in law to grant such an extension.

All this, as you can see, is very discouraging when it comes to really protecting your rights in your plans by copyrighting them. But fortunately in 1967 a case was decided which may give some future hope for the value of actually copyrighting architectural plans. This is the case of *Scholz Homes Inc. vs. Maddox*. 379 Fed. 2nd 84. In that case, while the plaintiff was not successful because the court found that neither defendant utilized the plaintiff's copyrighted plans, nevertheless the court had some constructive views which may prove pertinent in subsequent litigation. The court indicated

that copyrighted architectural plans should be treated differently from copyrighted books, and that the principles enunciated by the Supreme Court in the *Baker* case should be held inapplicable to copyrighted plans. The only protected category into which the Supreme Court could fit the treatise on bookkeeping, the subject of that case, was that of "books", and it was obvious to the court that the book in question had been written for the purpose of instructing others in the art of bookkeeping. It is far less obvious that architectural plans are prepared for the purpose of instructing the general public as to how the depicted structure might be built. Rather, they are often prepared so that they may be used in the building of unique structures, or at least structures limited in number. If the copyright statute protected purely against the selling of plans instead of against their unauthorized use, it would therefore fail to afford a form of protection architects might strongly desire. This protection would most effectively be provided by holding the unauthorized construction of a building according to a copyrighted plan to be an infringement. If, said the court, the *Baker* case is to be followed to the extent of holding that the possession of the copyright on the plans gives no exclusive right to construct the building, then protection could be provided by declaring the making of unauthorized copies of the plans to be an infringement in itself.

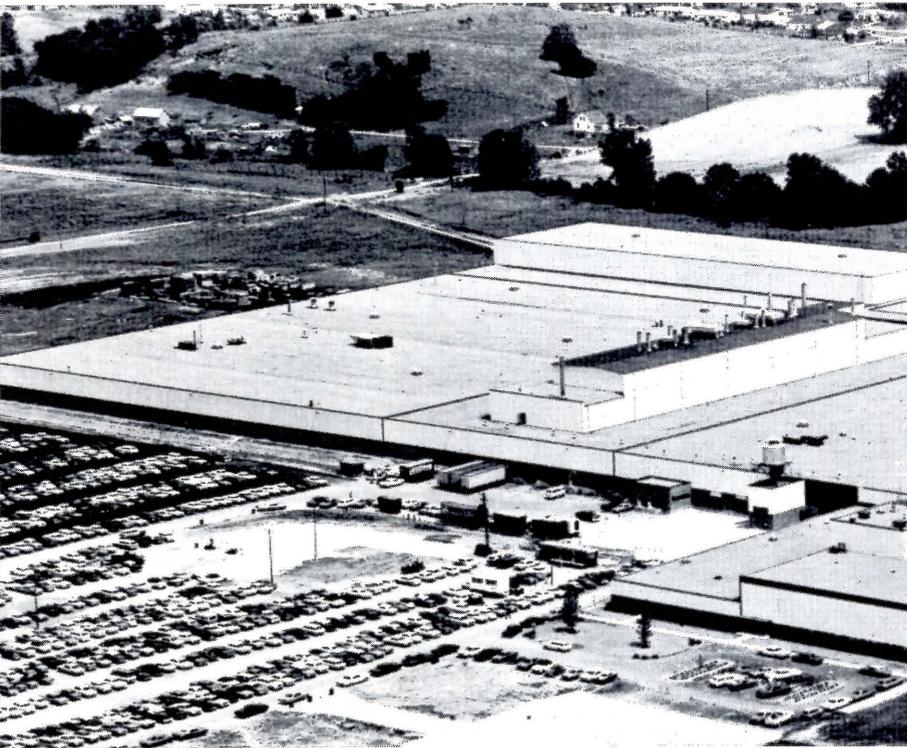
State when your plans depict a work of art

If the architectural plan or drawing is copyrighted as a work of art under Section 5(g) of the Copyright Act, rather than simply as a scientific or technical work under Section 5(i), the copyright proprietor is given the exclusive right to complete, execute and finish it. Hence, it would seem to follow that one who wrongfully builds a structure from plans copyrighted under Section 5(g), would infringe the designer's "completion" and "execution" rights. In *Jones Brothers Co. vs. Underkoffler*, 16 Fed. Supp. 329, wherein a cemetery monument was deemed properly copyrightable under Section 5(g) as a design for a work of art, the defendant's construction of a similar monument from the copyrighted plans was held to constitute an infringement. The court said that the test of infringement in such a case is whether the defendants have made an original, independent production or a copy of the plaintiff's work. The court noted that the testimony showed that the work of the defendant was not original but that it was copied, with several changes, from the copyrighted work. The evidence showed that the design from which the defendant's monument was made was traced from the copyrighted design.

Architects should seek opportunities to point out to legislators that plans are neither publications nor commodities, but represent unique designs for which protection is required by clarified or new laws.

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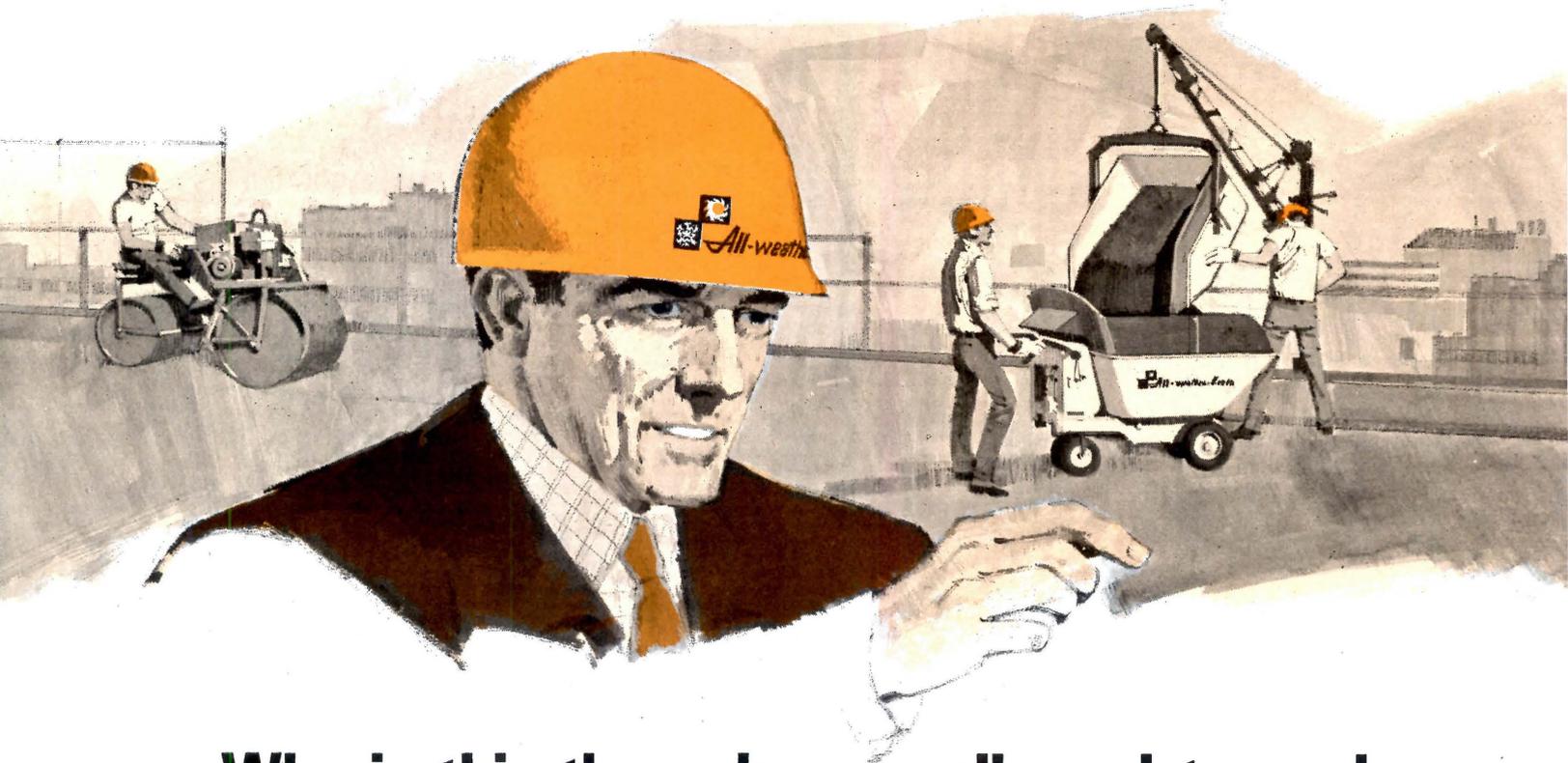
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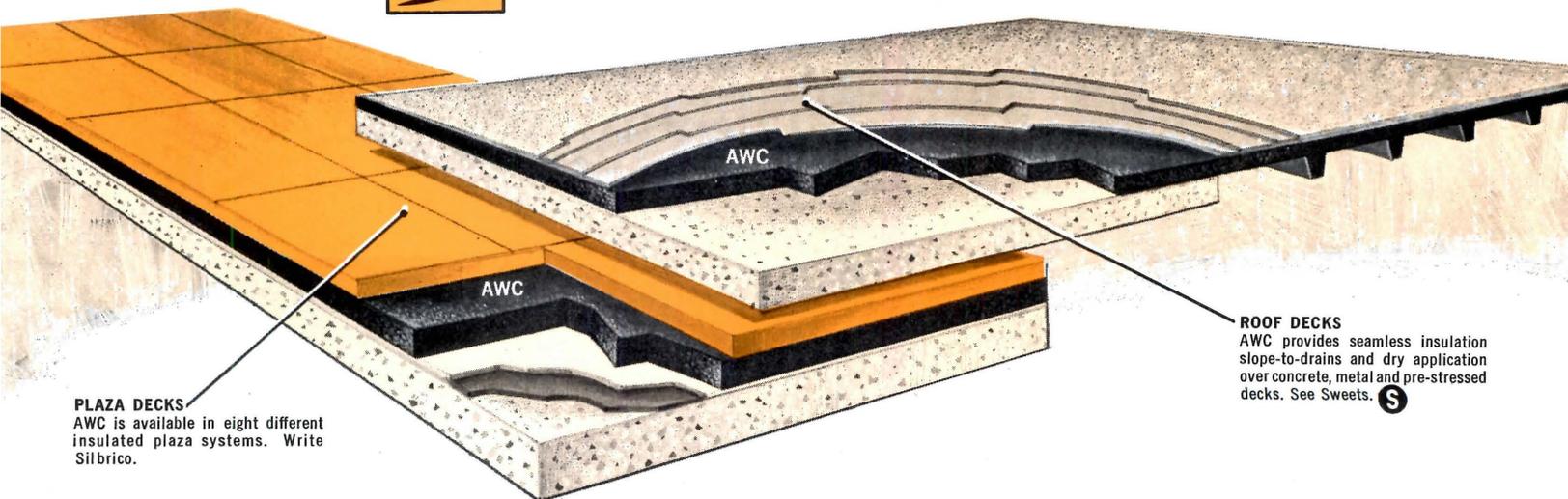
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CURRENT TRENDS IN CONSTRUCTION

James Carlson
 Manager, Economic Research
 McGraw-Hill Information Systems Company

1970, The year of the traveler

If the 1970 Federal Aid Highway Act becomes law this year—and at this writing, it appears likely that it will—1970 may well be remembered as the Year of the Traveler. The Federal Aid Highway Act will join two other pieces of transportation legislation already on the books, the Airport and Airway Development and Revenue Act of 1970, and the Urban Mass Transportation Assistance Act of 1970.

The highway bill provides for extending the Highway Trust Fund, which under present law expires in September, 1972, out through fiscal 1976 or 1977. (Depending on whether the Senate or the House version ultimately prevails.) It also contains some features that serve to orient it a few more degrees in the direction of the issues of today, ecology and the urban problem. But, by and large, the bill is designed to do what highway bills have been designed to do since the program got off the ground in 1956, build highways.

The highway program with its trust fund-user taxes approach has come under increasing criticism recently; a sampling of which follows:

- Since the average family finds the automobile pretty much a necessity, it has little choice but to pay gasoline and other user taxes. There is no logical basis for regarding the payment of these taxes as a "vote" for more highways.
- From the equity standpoint, why should gasoline and similar taxes go for building highways, when excise taxes on things like alcoholic beverages are not used to build distilleries, or treatment facilities for alcoholics?
- Even if the view that proceeds from things like the gasoline tax should be spent only to benefit highway users is valid, there is no necessary reason why they should be spent on highways per se. A mass transit system might be a great benefit to highway users if it substantially limits highway congestion.
- Since the Highway Trust Fund doesn't provide for maintenance costs, it places a heavy burden on states and municipalities that must bear these costs.
- The trust fund approach has misallocated resources in that it has induced

municipalities to attempt to solve their local mass transit problems by routing Interstate highways (90% Federally financed) through their downtown areas. In many cases, solutions like a mass transit system would have been more socially beneficial.

- The creation of a trust fund for a particular transportation mode precludes the consideration of other modes as a possible alternative. It makes it extremely difficult to take a broad environmental approach to a particular transportation problem. (The 1970 Highway Act contains a provision stating that consideration must be given to alternative means of solving the particular problem, though.)
- The trust fund approach effectively "locks in" expenditures over long periods of time, on the assumption that today's important priorities will still be the important priorities five or ten years from today.

One thing that can't be criticized about the program, though, has been its effectiveness in doing what it was designed to do. Oh, how it got highways built! Since the beginning of the Highway Trust Fund program in 1956, highway contracts have grown at a compound rate of five per cent per year. Of the more than \$75 billion in construction contracts for streets, highways and bridges that McGraw-Hill's Information Systems Company has reported since 1956, two-thirds are estimated to be a direct result of either the Interstate or ABC highway programs, initiated in that year.

Deaf to the criticism of the trust fund approach, but well aware of how effective it can be in getting the job done, Congressional sponsors reasoned that this method would be ideal for airport construction too. The Airport and Airway Development and Revenue Act passed this year contains a trust fund fueled by user taxes. (Everything, from foreign tickets and air cargo waybills to airplane tires and tubes, falls under the levy.) More than \$10 billion is expected to flow into the fund during the next ten years, but not all of this is slated for airport construction programs. A lot will go for air navigation facilities. For the near term, the bill provides \$280 million a year for the next five years for airport development. These

grants are on a 50/50 matching basis, so the construction potential of the Act is \$560 million a year.

The total spent on these facilities was more than \$560 million on both 1968 and 1969, however. And this hasn't been enough. Federal, state and local governments were spending only one-third more on airport facilities last year than they spent in 1960. Air passenger travel increased threefold over this period.

Concerned with getting commuters out of their cars and back into the subways and buses, the nation's mass transit systems have sharply increased their capital outlays during the 1960's. Outlays went from \$90 million in fiscal year 1960 to more than \$550 million last year. These expenditures probably kept the decline in mass transit patrons from going still lower. The task in the years ahead, of course, is to stop the decline entirely, and induce a rising trend in the number of mass transit patrons.

The Urban Mass Transportation Assistance Act of 1970 was passed with this task in mind. The Act *intends* to provide \$10 billion for urban mass transportation over the next 12 years. The amount actually appropriated is limited to a schedule contained in the Act. The schedule authorized \$80 million in fiscal year 1971 (on top of the \$214 million already in the budget) and rises at a graduated amount to \$1.86 billion in fiscal year 1975, and to \$3.1 billion thereafter. Estimates of mass transit capital expenditures *requirements* over the next ten years run to more than \$30 billion. This compares with \$2.5 billion actually *spent* in mass transit during the decade of the 1960's.

Of course the intention of an Act, and what ultimately results can often be very far apart. What are the prospects for the Federal Government holding up its end of the bargain? The pressure to keep the Federal budget in as close to a balanced position as possible is a perennial fact of life among federal agencies. In fact, there is talk that some of the funds for this program and the highway program may be held up for a while as a budget cutting play. Things like this are inevitable from time to time. But, the beauty of the trust fund approach is that, unless the law is rescinded, user tax revenues continue to build up, and must be spent eventually.

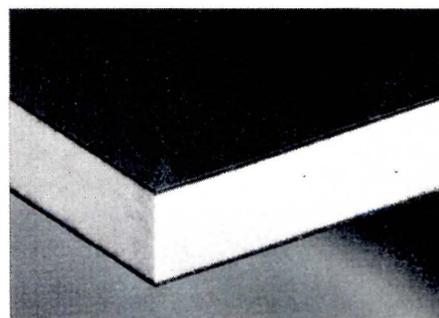
Mass transit funds are not protected in this fashion. Their fate rests solely on the degree of concern over air pollution, traffic congestion, and the other negative aspects of the automobile.



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INDEXES AND INDICATORS

William H. Edgerton
 Dodge Building Cost Services
 McGraw-Hill Information Systems Company

BUILDING COSTS CONTINUE CLIMB

Several decades prior to 1965, building cost increases varied in some relation to the state of the nation's economy. However, due to long-term inflationary labor contracts, building costs will continue their climb even in an economic downturn. The strike at General Motors, for example, had significant effects on the economy but caused no change in the building cost spiral.

Building cost indexes

The information presented in the tables indicates trends of building construction costs in 33 leading cities and their suburban areas (within a 25-mile radius). The table to the right presents correct cost indexes for non-residential construction, residential construction, masonry construction and steel construction. The latter two indexes are new to the RECORD. Differences in costs between two cities can be compared by dividing the cost differential figure of one city by that of a second city.

The table below presents historical building cost indexes for non-residential construction; future costs can be projected after examining past trends.

All the indexes are based on wage rates for nine skilled trades, together with common labor, and prices of five basic building materials are included in the index for each listed city.

1941 average for each city = 100.00

Metropolitan area	Cost differential	Current Indexes				% change year ago res. & non-res.
		non-res.	residential	masonry	steel	
U.S. Average	8.5	338.1	317.4	331.8	324.0	+ 7.31
Atlanta	7.8	427.4	402.9	416.7	410.7	+10.21
Baltimore	7.9	354.6	333.3	345.4	338.9	+ 8.23
Birmingham	7.2	313.2	291.3	306.1	300.4	+ 2.15
Boston	8.7	332.7	314.3	329.6	320.6	+11.60
Buffalo	9.2	380.9	357.7	374.6	364.1	+10.15
Chicago	8.8	391.4	372.1	379.1	373.7	+ 8.65
Cincinnati	9.0	352.9	332.0	347.3	339.0	+ 7.14
Cleveland	9.8	385.2	362.4	377.7	369.8	+ 6.27
Columbus, Ohio	9.0	368.0	345.6	358.8	352.4	+ 8.69
Dallas	7.7	330.0	319.5	322.1	316.5	+ 6.21
Denver	8.4	372.0	350.0	369.4	357.0	+ 8.79
Detroit	9.5	381.3	363.2	380.4	367.6	+ 7.11
Houston	8.1	326.9	307.0	319.9	313.7	+ 6.83
Indianapolis	8.8	312.7	293.6	306.9	300.3	+ 3.39
Kansas City, Mo.	8.2	319.2	301.6	312.0	306.3	+ 6.89
Los Angeles	8.1	369.6	337.8	358.2	352.6	+ 5.34
Louisville, Ky.	8.1	331.3	311.1	324.6	318.3	+ 7.16
Memphis	7.8	325.5	305.6	318.2	311.6	+ 6.12
Miami	8.6	357.3	340.4	351.0	342.9	+ 7.43
Milwaukee	9.2	393.4	369.4	389.5	376.7	+ 6.19
Minneapolis	8.9	364.9	343.3	359.2	349.7	+ 9.24
Newark	9.0	340.6	319.8	335.2	326.9	+ 9.78
New Orleans	7.9	323.0	304.8	318.2	311.2	+ 7.38
New York	10.0	374.3	348.0	362.0	354.6	+ 6.44
Philadelphia	8.5	350.2	333.5	343.7	335.5	+ 8.13
Phoenix	8.2	186.7	175.2	180.6	178.1	+ 5.81
Pittsburgh	9.1	330.6	311.0	326.1	317.8	+ 5.39
St. Louis	9.2	348.7	329.1	345.6	334.2	+ 6.24
San Antonio	8.0	138.0	129.6	135.2	131.6	+ 9.06
San Diego	8.2	137.3	128.9	134.6	131.5	+ 7.81
San Francisco	9.0	475.2	434.3	468.6	455.4	+ 5.59
Seattle	9.0	350.5	313.7	348.5	334.2	+ 7.73
Washington, D.C.	7.7	312.5	293.4	305.5	299.4	+ 8.19

Cost differentials compare current local costs, not indexes.

HISTORICAL BUILDING COST INDEXES—AVERAGE OF ALL BUILDING TYPES, 21 CITIES

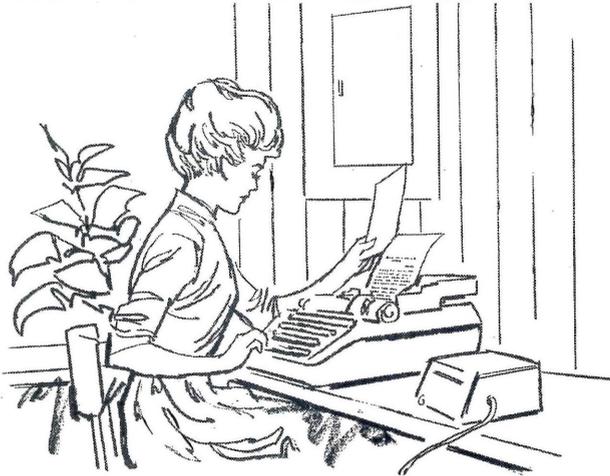
1941 average for each city = 100.00

Metropolitan area	1962	1963	1964	1965	1966	1967	1968	1969 (Quarterly)				1970 (Quarterly)			
								1st	2nd	3rd	4th	1st	2nd	3rd	4th
Atlanta	298.2	305.7	313.7	321.5	329.8	335.7	353.1	364.2	365.9	382.8	384.0	399.9	406.2	402.9	
Baltimore	271.8	275.5	280.6	285.7	290.9	295.8	308.7	311.4	313.0	321.8	322.8	323.7	330.3	326.3	
Birmingham	250.0	256.3	260.9	265.6	270.7	274.7	284.3	288.4	289.9	302.4	303.4	303.5	308.6	305.9	
Boston	239.8	244.1	252.1	257.8	262.0	265.7	277.1	278.2	279.6	294.0	295.0	300.5	305.6	303.1	
Chicago	292.0	301.0	306.6	311.7	320.4	328.4	339.5	340.4	342.1	354.9	356.1	362.2	368.6	365.1	
Cincinnati	258.8	263.9	269.5	274.0	278.3	288.2	302.6	309.8	311.5	324.8	325.8	332.8	338.4	335.4	
Cleveland	268.5	275.8	283.0	292.3	300.7	303.7	331.5	334.9	336.7	357.1	358.3	359.7	366.1	362.7	
Dallas	246.9	253.0	256.4	260.8	266.9	270.4	281.7	287.2	288.7	307.6	308.6	310.4	314.4	313.0	
Denver	274.9	282.5	287.3	294.0	297.5	305.1	312.5	317.9	318.5	337.9	339.0	343.4	348.4	346.2	
Detroit	265.9	272.2	277.7	284.7	296.9	301.2	316.4	326.8	328.5	351.8	352.9	355.2	360.5	356.3	
Kansas City	240.1	247.8	250.5	256.4	261.0	264.3	278.0	281.0	282.3	294.5	295.5	301.8	306.8	304.5	
Los Angeles	276.3	282.5	288.2	297.1	302.7	310.1	320.1	323.7	325.4	343.0	344.1	346.4	355.3	349.3	
Miami	260.3	269.3	274.4	277.5	284.0	286.1	305.3	309.6	311.2	328.3	329.3	338.2	343.5	341.1	
Minneapolis	269.0	275.3	282.4	285.0	289.4	300.2	309.4	310.6	312.2	330.1	331.2	341.6	346.6	346.6	
New Orleans	245.1	248.3	249.9	256.3	259.8	267.6	274.2	285.5	287.1	296.6	297.5	305.4	310.6	307.9	
New York	276.0	282.3	289.4	297.1	304.0	313.6	321.4	324.9	326.6	343.4	344.5	351.1	360.5	353.2	
Philadelphia	265.2	271.2	275.2	280.8	286.6	293.7	301.7	304.6	306.2	320.0	321.0	328.9	337.7	331.7	
Pittsburgh	251.8	258.2	263.8	267.0	271.7	275.0	293.8	297.0	298.6	310.0	311.0	316.9	321.6	319.5	
St. Louis	255.4	263.4	272.1	280.9	288.3	293.2	304.4	306.8	308.3	323.7	324.7	335.2	340.8	338.0	
San Francisco	344.3	352.4	365.4	368.6	386.0	390.8	402.9	415.6	417.5	439.9	441.1	455.4	466.9	458.1	
Seattle	252.5	260.6	266.6	268.9	275.0	283.5	292.2	296.1	297.5	316.8	317.8	325.4	335.1	328.1	

Costs in a given city for a certain period may be compared with costs in another period by dividing one index into the other; if the index for a city for one period (200.0) divided by the index for a second period (150.0) equals 133%, the costs in

the one period are 33% higher than the costs in the other. Also, second period costs are 75% of those in the first period (150.0 ÷ 200.0 = 75%) or they are 25% lower in the second period.

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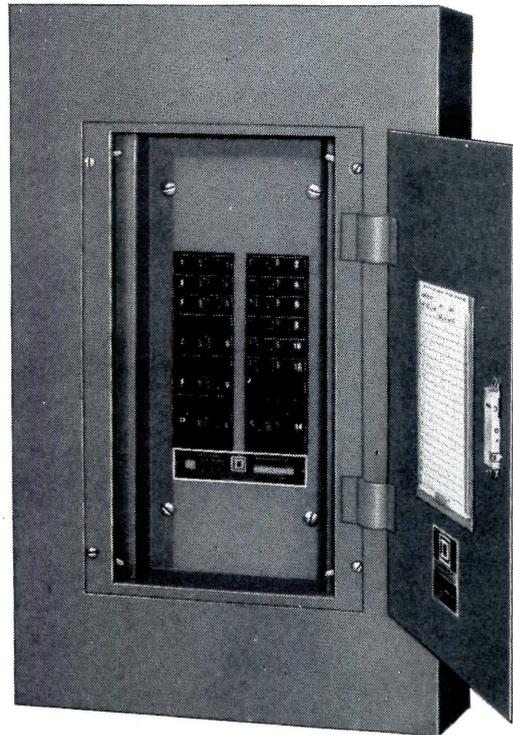
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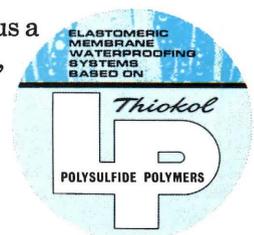
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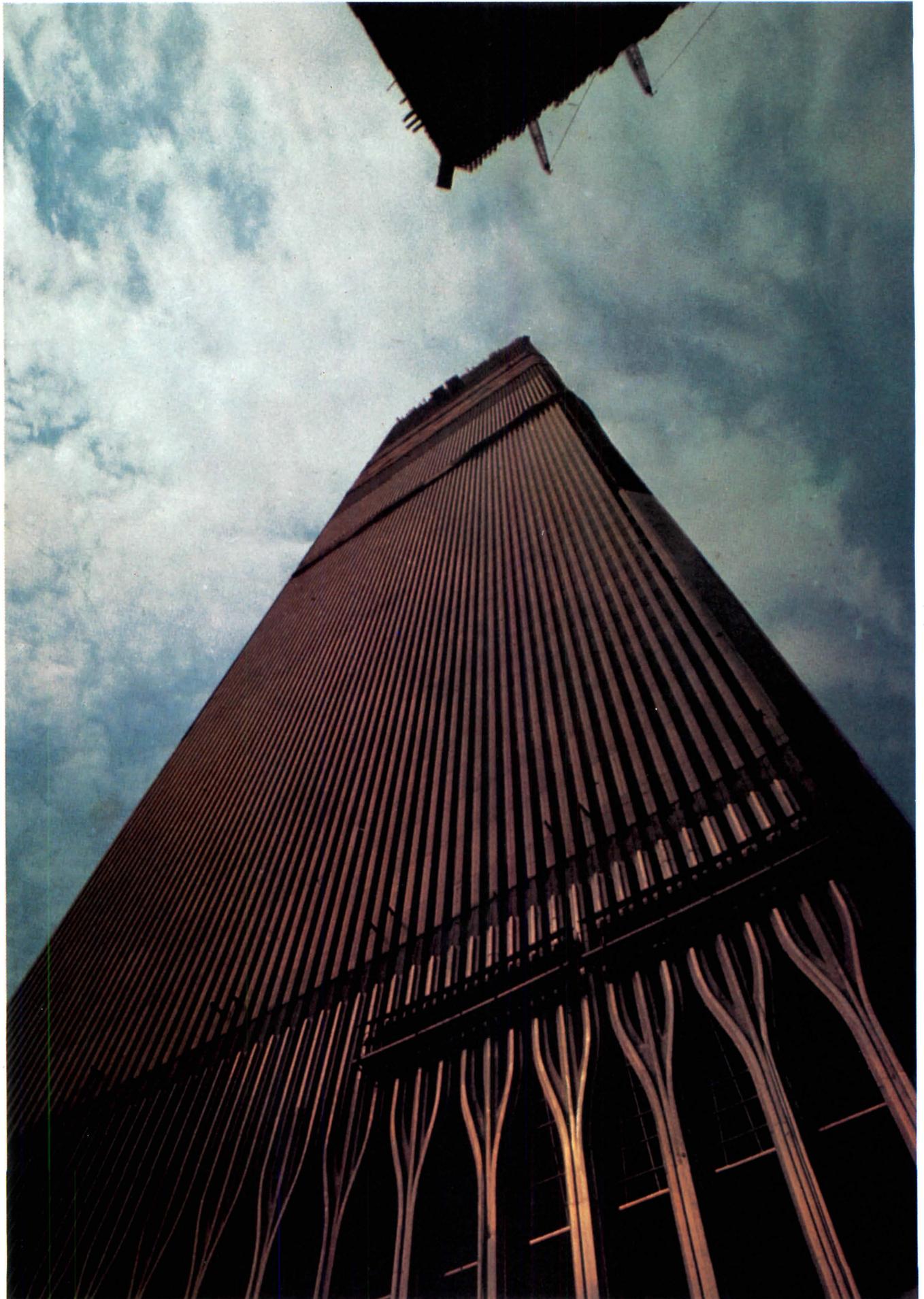
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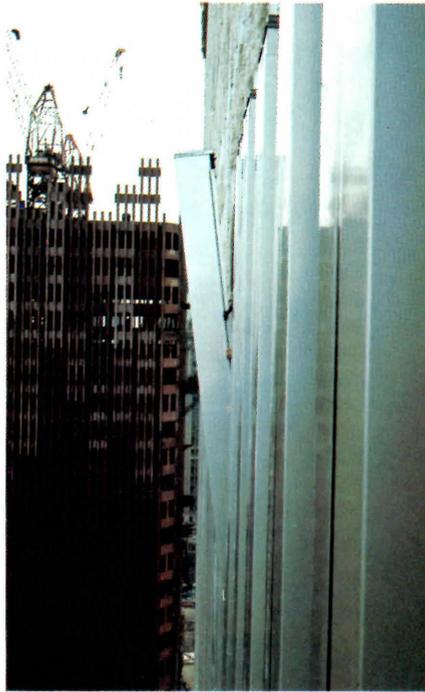
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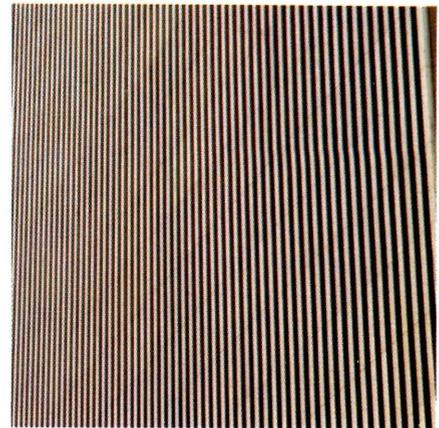


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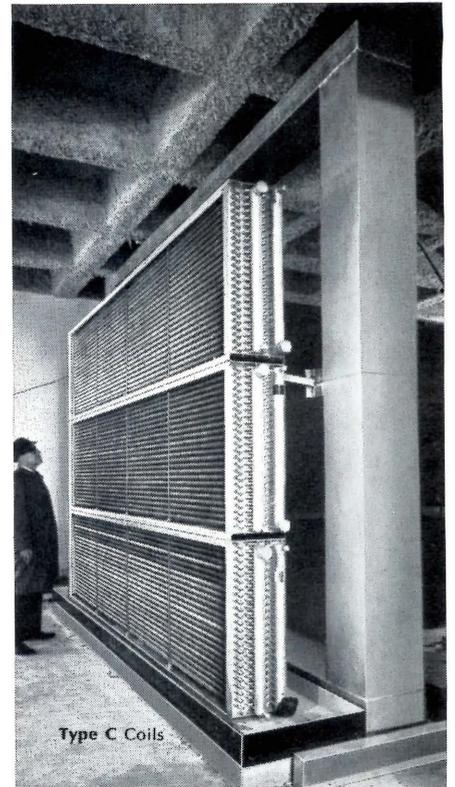
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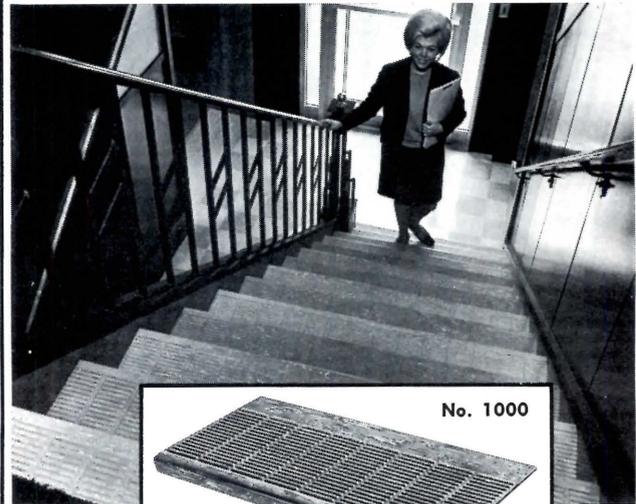
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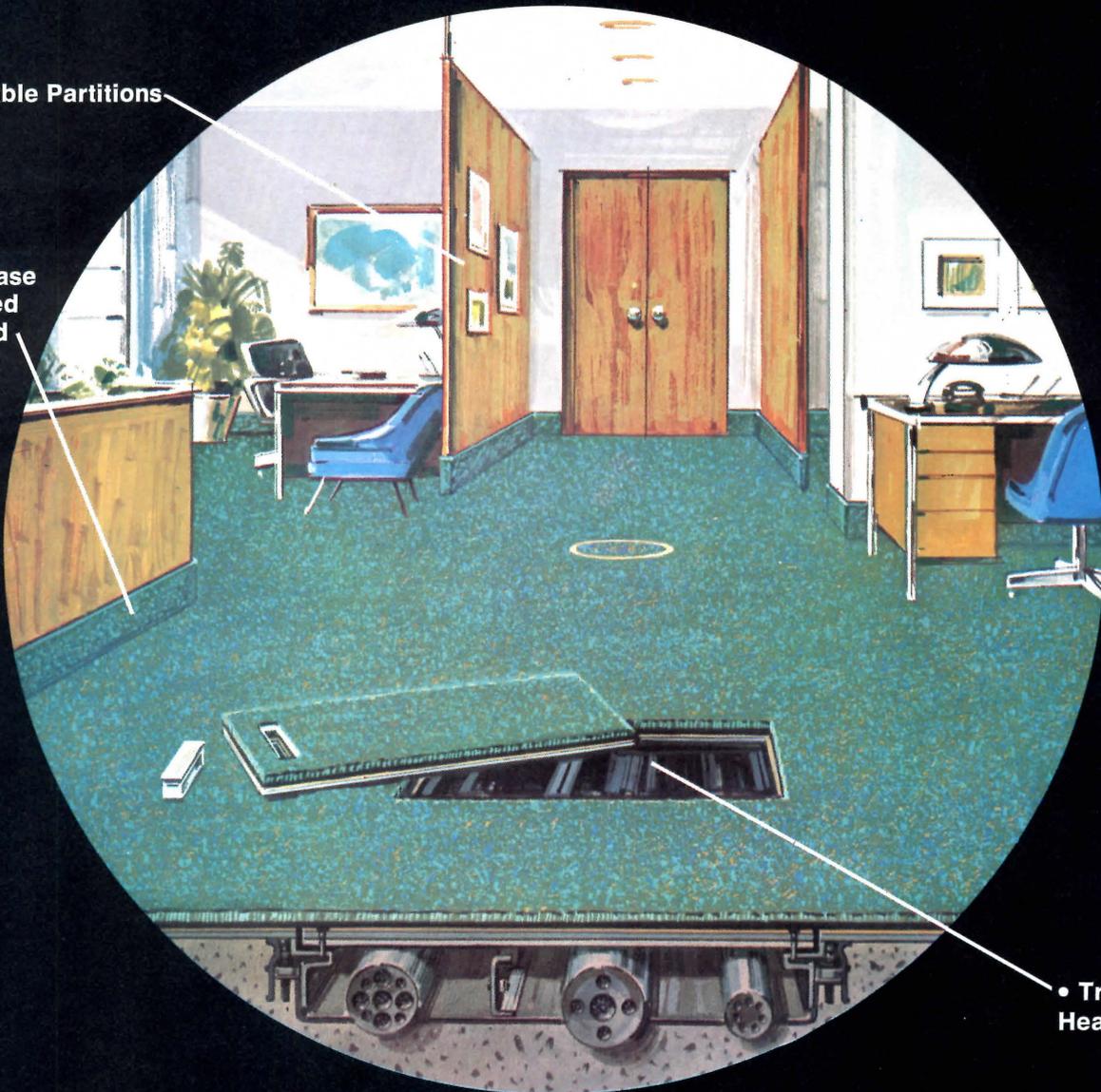


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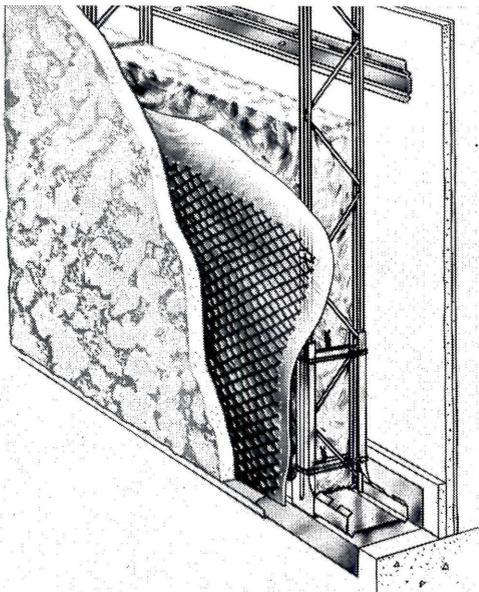
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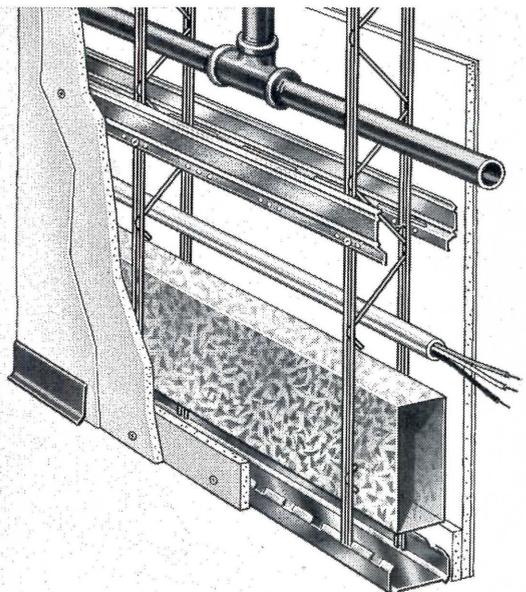
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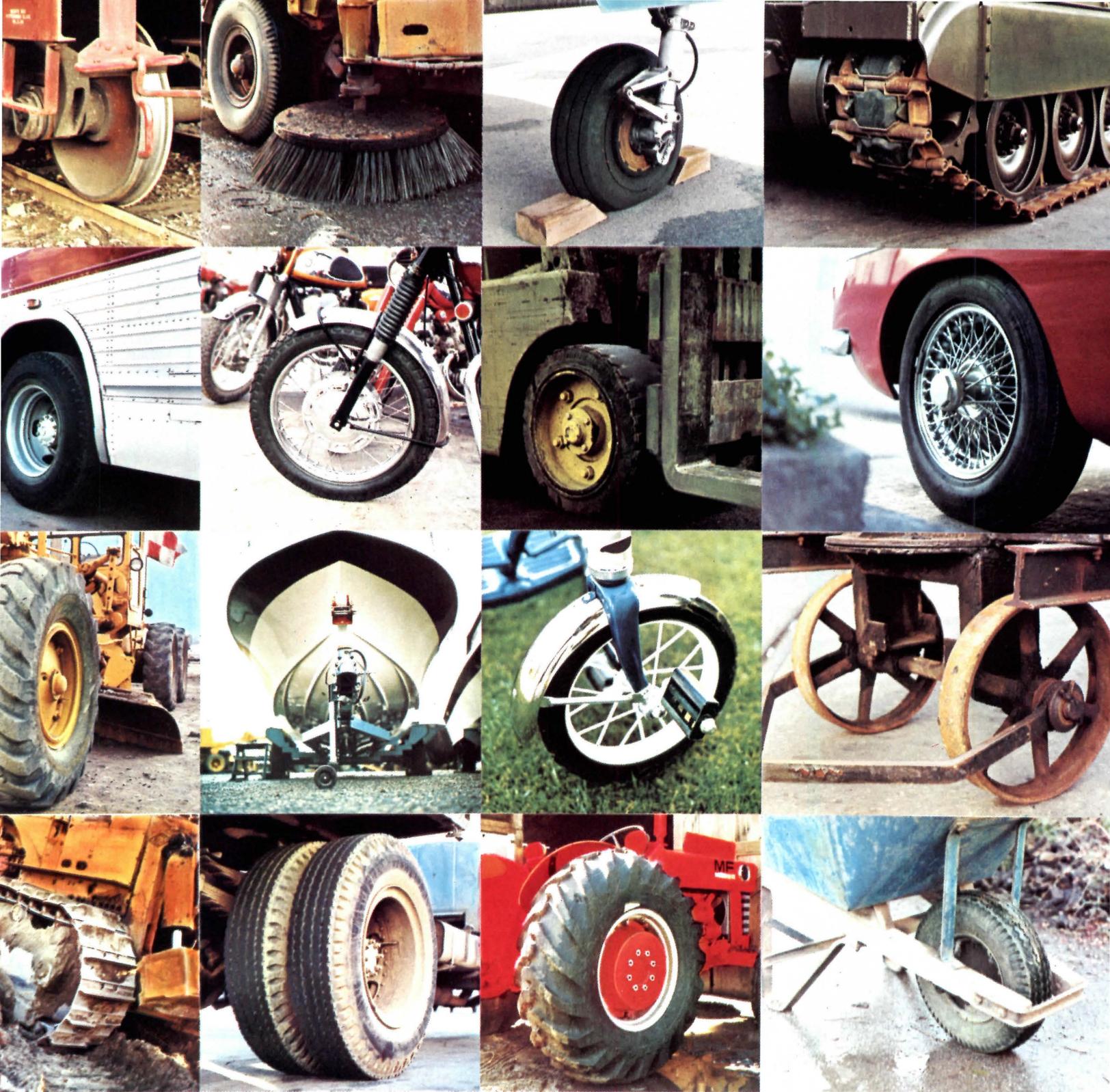
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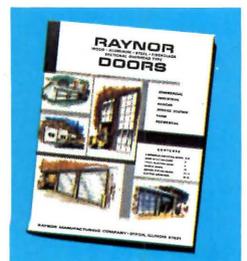


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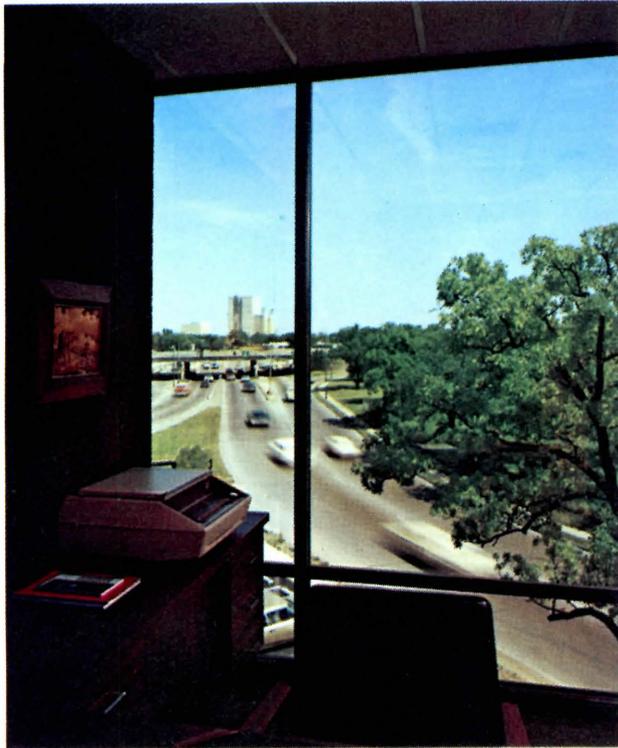
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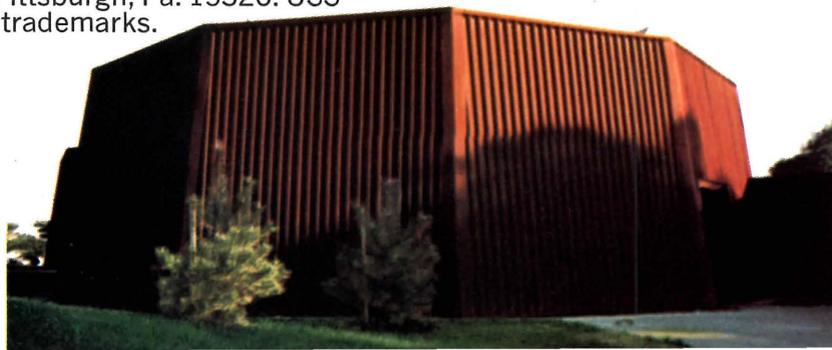
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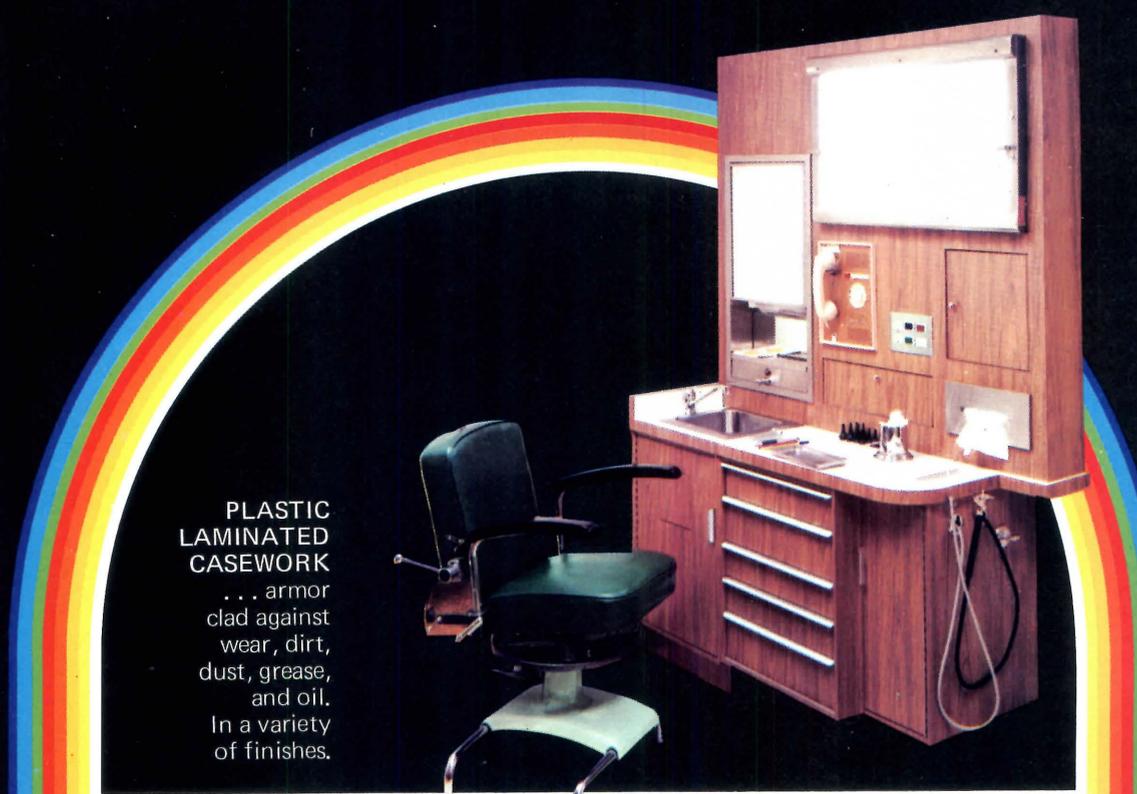
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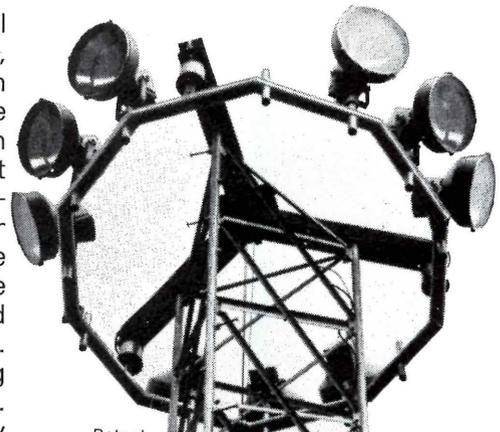
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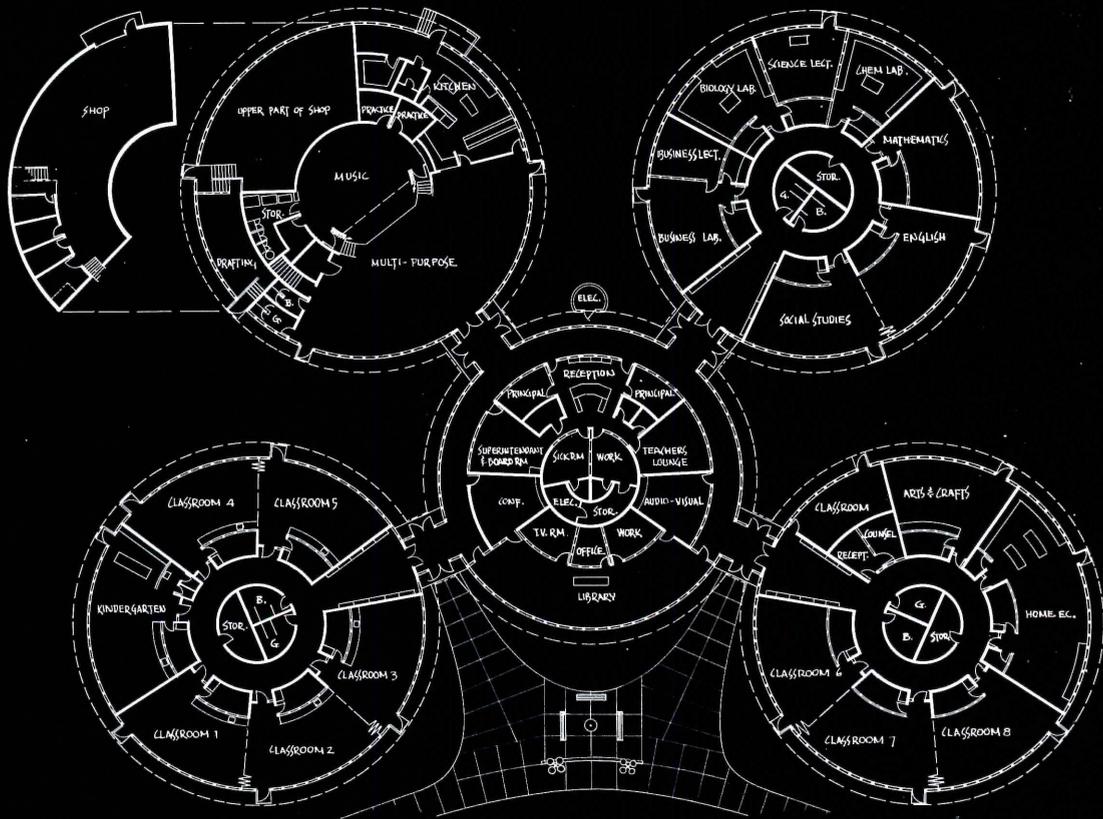
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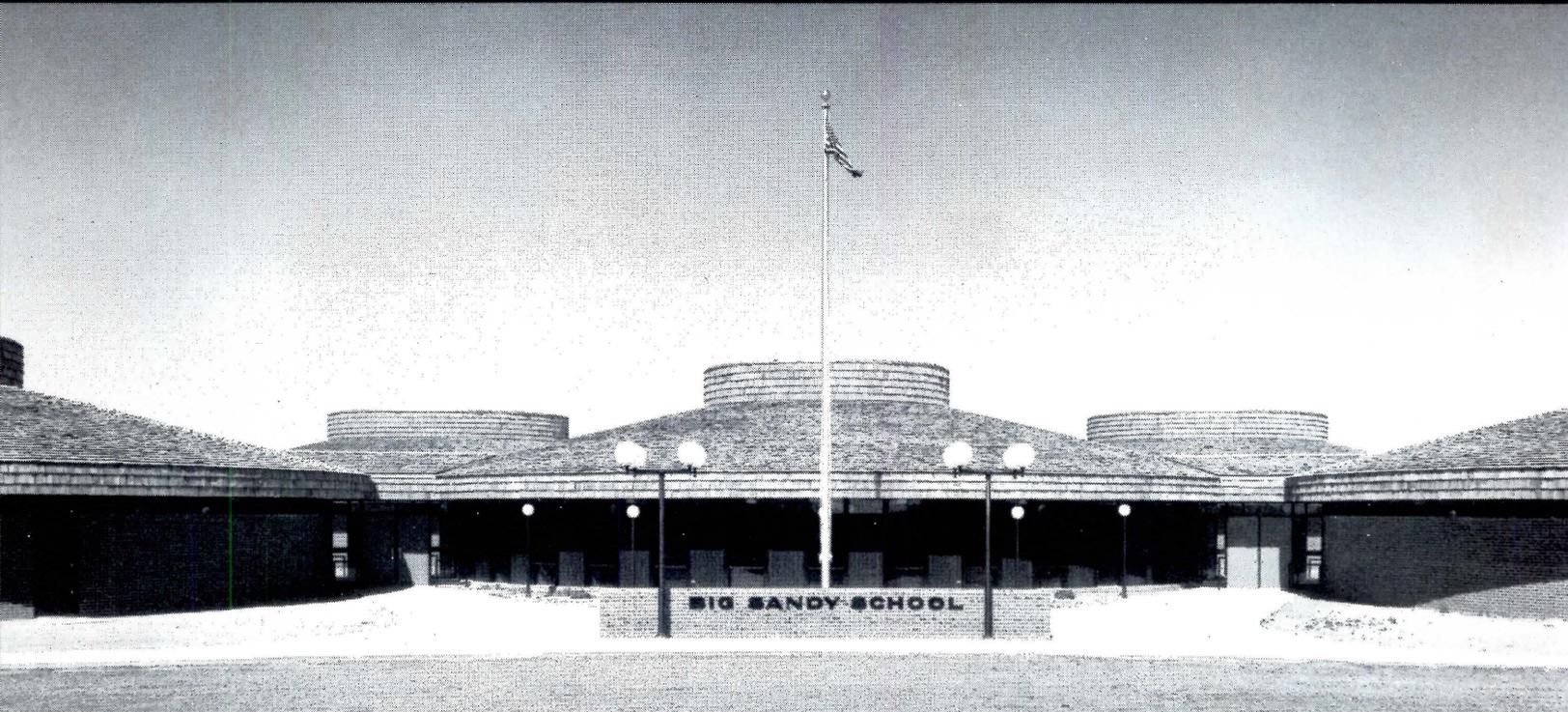
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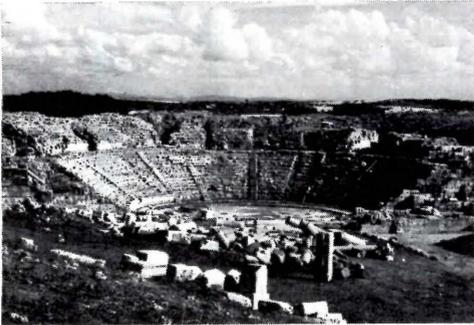
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CONCERT SHELL FOR A ROMAN RUIN

The ancient Roman theater in Caesarea, Israel shown before restoration (left) has been equipped with a new stage and an acoustical shell (below) for symphonic music, smaller musical groups and soloists. The shell is movable and by day is concealed within a revetment in a low hill nearby.

This solution was in response to the demand by archaeologists that no elements foreign to the ancient building be allowed to destroy the romantic essence of the site. The design, by George C. Izenour, Professor of Theater Design and Technology, Director of the Electro-Mechanical Laboratory at the Yale School of Drama and noted theater consultant, is in his words the result of a "rare conjunction occurring in Caesarea among the forces of government, archaeology, architecture, engineering and the performing arts. A time span of two thousand years was telescoped into a project which brought together people of many different talents, nationalities and experience. Modern communications, air travel, technology, instrumentation and structural engineering all played a part and in the end were made common cause with the excavated ruin of an ancient theater building." In the article which follows, Professor Izenour not only describes the Caesarea Festival Theater's acoustical problem and its solution, but draws upon his vast knowledge of the history of theater design and performance to place this contemporary design within a broad cultural and technological context.

Paul Gross photos



The site and its history

Halfway between Tel Aviv and Haifa on the Palestinian shore of the eastern Mediterranean lies buried the ruin of one of the great maritime cities of the Roman Empire—Caesarea Judea. Founded by King Herod the Great and named by him in honor of Caesar Augustus, this site has been occupied, off and on, for over 3,000 years by Phoenicians, Jews, Romans, Byzantines, Norman French, Venetians, Arabs and Turks and other waves of peoples who have come and gone. In the first century before Christ, Herod built this great city with Roman engineering help. Fragments of its artificial harbor and masonry breakwater still remain after twenty centuries. Hard by this harbor is one of the ancient city's great buildings, a Roman theater excavated in 1958-60 by an Italian archaeological team headed by Professor Antonio Frova, Istituto Lombardo-Academia di Scienze e Lettere, Milano. In Biblical times it was from Caesarea that Pontius Pilate and a succession of Roman procurators administered Roman justice and ruled in the name of Caesar the nation of the Hebrews, and from which St. Paul embarked on the missionary journey that took him to Rome. A thousand years later it was in Caesarea that the Crusaders established a fortress-beachhead manned by the knights of St. John, but which fell before the onslaught of Islam. In our time it is in Caesarea that Pablo Casals, Alexander Schneider, Isaac Stern, Leonard Bernstein, Igor Stravinsky, Yehudi Menuhin, William Walton and others make music in the excavated ruin of this ancient theater before an audience of Israelis in the land of their forefathers. Caesarea has become the setting of one of few

attempts by the combined forces of modern archaeology, architecture and engineering to restore the ruin of an ancient theater building to suit the exacting requirements of the contemporary performing arts. This is by no means the first or only attempt. The Greek theater at Epidaurus in the Peloponnese has for many years been the site of a modern revival in the open-air of the drama of ancient Greece in a festival setting, and



the partially restored Roman theater of Herod Atticus in Athens has been used for summer performances of music and drama. The Roman Theater at Orange in southern France and others have been used as outdoor auditoria for a great variety of performance and related activities. That there have been problems, mostly acoustical, that have mitigated against achieving wholly successful results is understandable, and what makes the attempt at Caesarea unique is the recognition by the Israelis that in truth problems did exist. The problems are usually ignored.

The acoustical problem

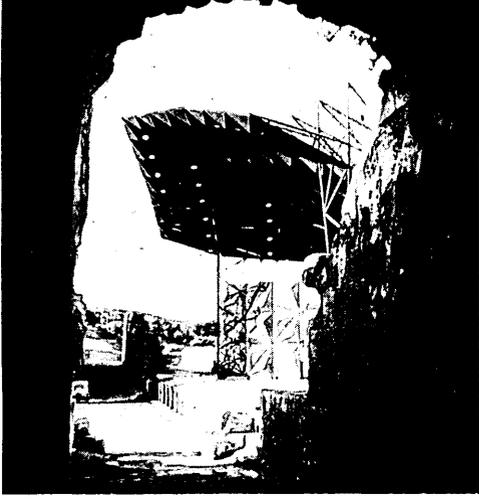
First of all, modern music, drama, and opera, while in a sense descended from ancient forms, are in no way like them. The substance of the form and

the forces used for presentation are vastly different and even more important—the audience is different in its tradition, background, and conditioning. Modern audiences are used to enclosed theaters and concert halls which produce an acoustical result far different from that experienced in open air auditoria. The ancients as a general rule were not so conditioned. Some scholars have compared the drama of ancient Greece to the opera and music drama of our time, but this is at best conjecture. Certainly nothing akin to the symphony orchestra existed in ancient times and modern drama is vastly different from ancient drama. But from a practical point of view, with regard to seeing and hearing performance in an outdoor theater, the problem, at least in principle, was the same then as now. The Greek word *theatron*, from which is derived our word theater, means literally a place for seeing. Drama of the ancient Greeks developing from dithyrambic and epic poetry utilized to the full the sense of hearing. In the open-air auditorium the transmission of sound energy was dependent solely upon what could be carried along a path consisting of the straight line of sight from the actor on stage to the spectator in the audience.

Theories of Vitruvius

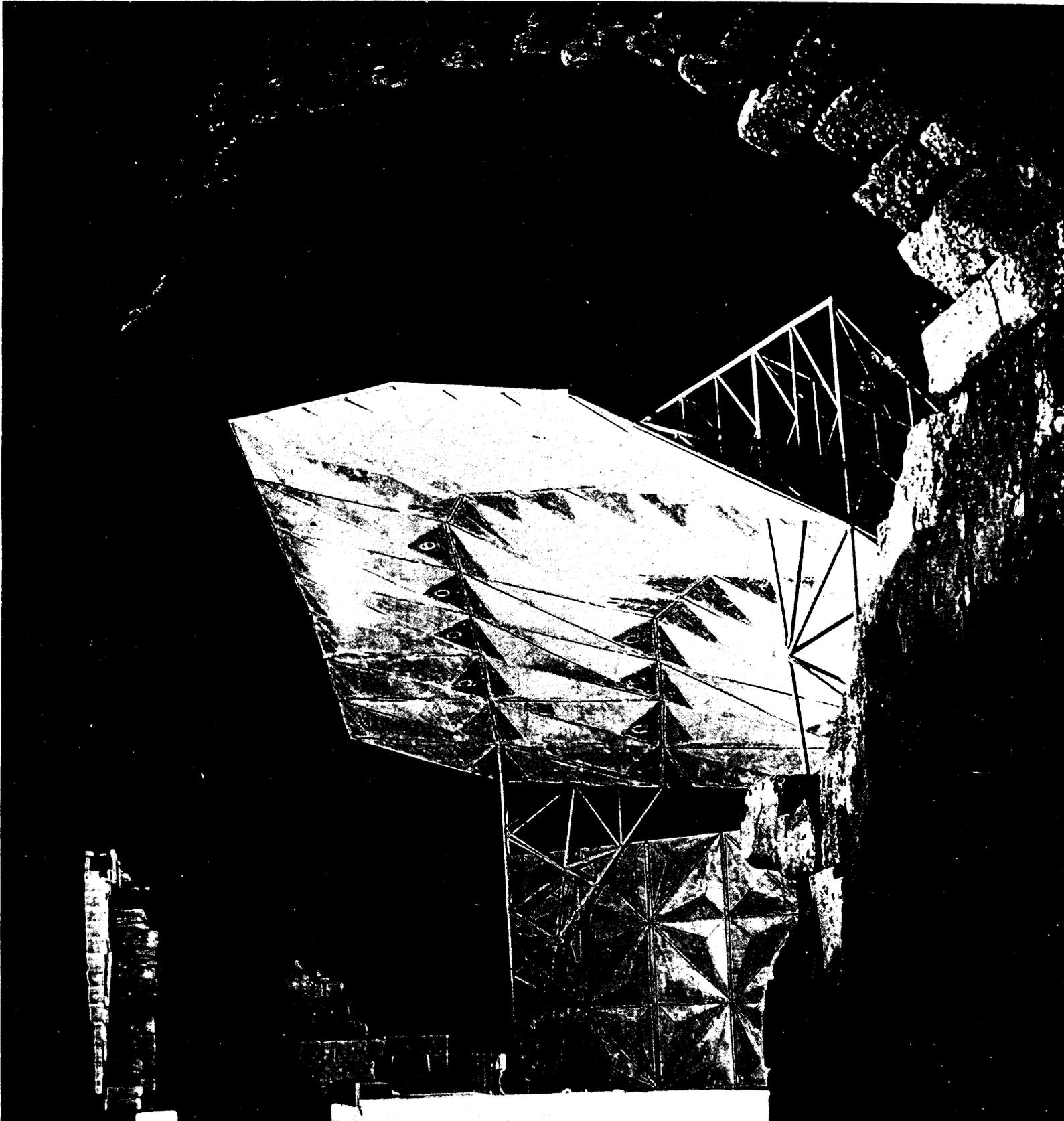
Acoustics are a difficult matter, as Vitruvius in his quaintly empirical treatise on architecture tells us. There is no doubt that acoustics presented as great a problem to the ancients as now, for why else would Vitruvius have so harped on the subject? Approximately 75 per cent of what he has to say about theater design is either directly or indirectly related to the subject of acoustics. And I do not believe

these observations were necessarily his own. He cites other sources, mostly of Greek origin. His treatise begins with a short introduction concerning site selection, which hints at a definition of satisfactory ambient acoustical conditions, he details how sight lines are derived, and so long as he sticks to Euclidean geometry he is on safe ground. But he proceeds to get involved in musical and pseudo-mathematical theory and the now infamous resonant sounding vessel theory of amplification, finally leaving earth for the stars, getting lost in astrology and music of the spheres. Is it any wonder that ever since, acoustics, in the lay mind, has conjured up associations with magic and witchcraft? His basic assumption concerning sight lines, however, is as correct today as it was then, and he makes a good case for seeing lines being also the basis for good hearing lines from a sound source located on stage to the spectators in the auditorium. But to the modern mind, conditioned by science, from this point on most of what he has to say is charming nonsense. Today, with the benefit of hindsight, it is easy to see why the ancients could go no further in understanding acoustics. It was their inability to make field measurements of even the simplest kind because basic instrumentation for the purpose did not exist. Nevertheless, they came close to identifying acoustics as an energy system, and we must give them credit for having the good sense at least to do as their senses directed. They were never guilty of permitting architectural conceits to transgress the essential functioning of the theater. The true explanation of how pressure stimuli worked for the seeing and hearing senses—that



The canopy as seen by day (left) and by night (below) was built in Israel of weathering steel. A kite-shaped two-way space truss, its multi-faceted geometry consists of a series of small triangles which form larger triangles. The structural skeleton is fabricated of 1½- and 2-inch weathering steel pipe. The acoustical infill is fabricated of 18-gauge dampened weathering steel. The side wall units when folded and pivoted form either a modulated

reflecting surface for music or a wing stage for dramatic presentation. The weight of the side walls is seven tons. The canopy, which includes its own lighting system, weighs 22 tons. The photographs show in juxtaposition two styles and systems of construction separated by 2,000 years—Roman stone masonry and contemporary tubular steel. Both are arch systems—the earlier spanning barely 12 ft, the later over 75 ft.



would one day be reduced to scientific reality as a train of waves and quanta—was 2,000 years in the future. In a more general sense it is the disparity between visual and aural sensation that has been, and in many ways still is, the problem central to theater design.

The search for a new approach

The first communication about the project at Caesarea was from Arnon Adar, the foremost Israeli stage and lighting designer, and an old friend of earlier times at Yale, who spelled out some of the problems being encountered. A subsequent directive with drawings and photographs from Yaacov Yannai, director for Israeli National Parks, indicated that symphonic music, smaller musical groups and soloists were the principal users and that all performances, due to extreme summer heat, were to be held in the cool of the evening under artificial light.

Both communications made no secret of an almost intolerable acoustical problem for listeners as well as performers, and aerial photographs revealed a nearby beach with pounding surf. A drawing marked up to show the prevailing winds revealed that they blew past the performer, whose back was to the beach, to the audience. From this information it was reasonable to deduce that windborne surf noise plus the effect of the wind itself was the principal problem and was responsible for a low signal-to-noise ratio. It was quite obvious that a shell structure that could collect, redirect and approximately double the sound energy over that presently experienced in the theater was *in order*. It is pointed out here that, contrary to popular belief, wind makes

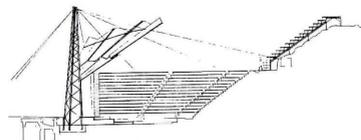
for a difficult ambient acoustical condition in open air auditoria. In addition to carrying outside extraneous noises it creates noise as it blows past the ear lobes. There is on record a scholarly opinion developed in support of the theory that ancient theaters were situated so that the prevailing wind blew from the performer to the spectator, putting forth the belief that prevailing winds in the right direction were an aid to acoustics. Acoustical measurements made at these distances in theaters by myself tell otherwise, and this theory is nonsense.

The first design

An acoustical shell design based on simple ray diagramming was begun in 1966 without benefit of direct contact with the users or a visit to the site, using aerial photographs and drawings of archaeological remains as the only sources of information. These documents indicated the Roman stage to be almost a complete ruin, and a few photographs showing recent use indicated that the stage itself was not being used and performance had taken place in the orchestra, which had been temporarily floored over with wood. The audience was forced to do the best it could—seating itself on an incline of rubble which was an accurate description of the condition of the seat bank. Since the usual shallow Roman stage was, for all practical purposes, non-existent, I visualized some sort of tension structure suspended on cables over the orchestra as the most efficient and economical structural solution. The critical acoustical mass for efficient energy reflection in acoustical shells is of the order of two to three pounds per square foot, which in my experience is easily achieved by

16- 18-gauge dampened steel sheet.

The first design consisted of a fixed central steel mast from which was strung a network of cables fore and aft, with the cables over the ancient orchestra supporting the acoustical canopy and a modulated rear wall placed behind. There was never a thought of using material other than steel which for some years I have been using in the design of acoustical structures in multi-purpose buildings for the performing arts. It is well known that dampened steel reacts to an acoustical energy field in the same way as its equivalent mass of wood, masonry, hard plaster and other materials. I am not a believer in the old saw proclaiming that "sound is round and wood is good." After the initial study, resulting in the first design (below) was completed,



I was invited to Israel for a first-hand look at the site and a conference with the client.

It was obvious, though tacit, that to a man they were horrified at my suggestion that a mast be permanently placed at stage center and cables be dead-manned into the seat bank as the essential elements of the design. I was not then aware of a previous decision to restore and use the Roman stage instead of the orchestra as the performing area, quite as the Roman designer had initially intended, and a subsequent visit to the site quickly convinced me of the correctness of this decision. Also, between the time I began work on the design and my first coming to Israel, the decision

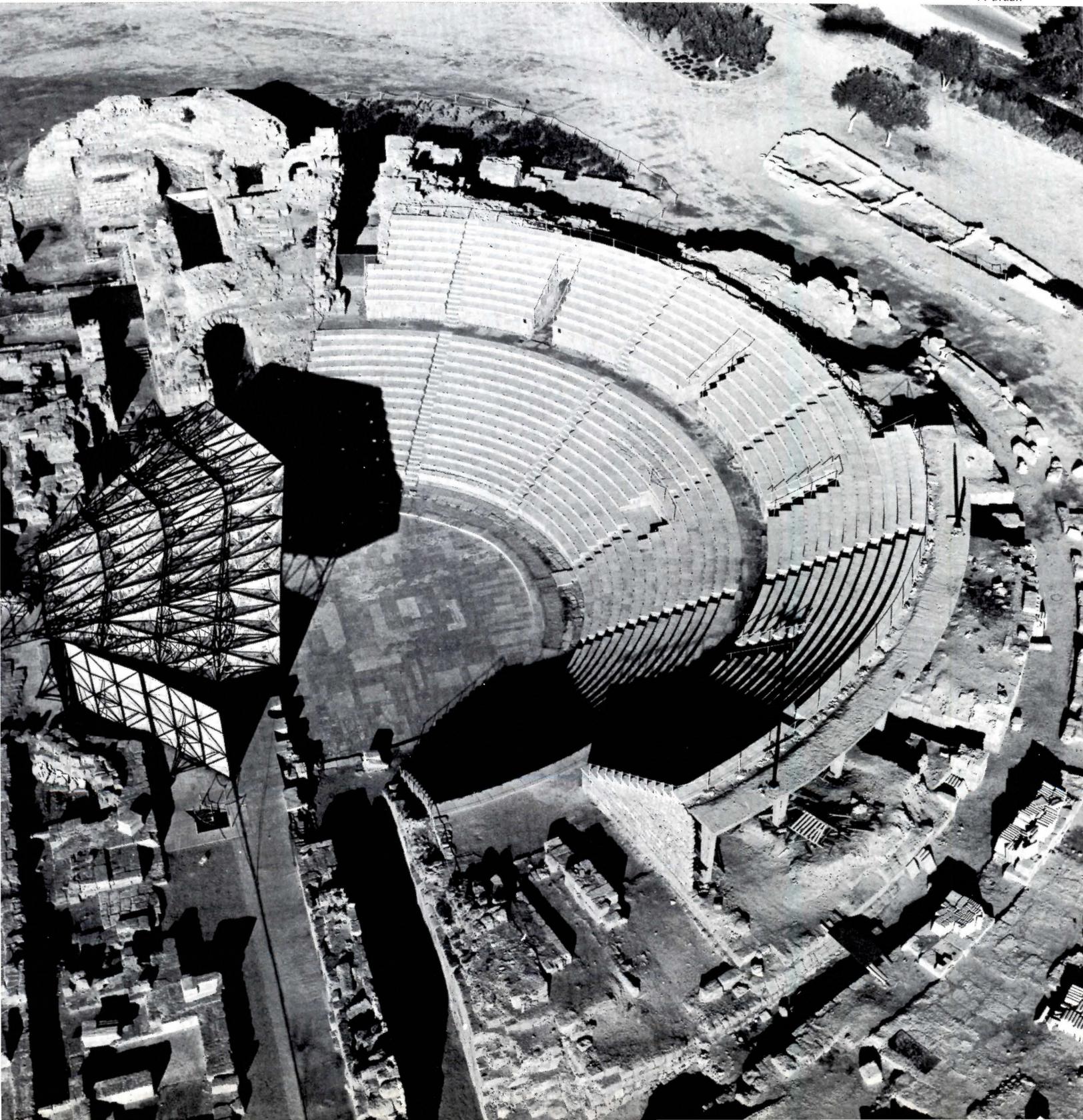
was made to restore the seating system with precast concrete panels of the same size and shape as the original masonry using rubble taken from the site as aggregate. This reconstruction made the audience at least as comfortable as its ancient counterpart. The work of restoring both stage and seatbank was well under way and, as a working committee, we were now ready to design in earnest. From the beginning, the department of antiquities people made the point that, no matter what acoustical and structural solution was eventually decided upon, the structure had to be movable because the archaeologists wanted to preserve as nearly as possible the excavated appearance of the site at all times when it was not in use for performance. For Caesarea, as an archaeological site and tourist attraction, this was a necessity. But on the other hand, the musicians complained bitterly and threatened not to ever again perform in the theater unless two essential requirements were met: first, provision to enable them to hear each other so they could play together; and second, just as important, provision for the audience to hear them without electro-acoustical help (amplification). To further complicate matters, it had been decided that in the future, works for the stage (opera, dance, and drama) would also be included in the program. This made it imperative that the acoustical solution for music be integrated with the stage as well.

A fresh start

To make a long story short, the tension structure was forthwith abandoned with no regrets and I returned home with clear directives on how to proceed, but not on how to solve the prob-

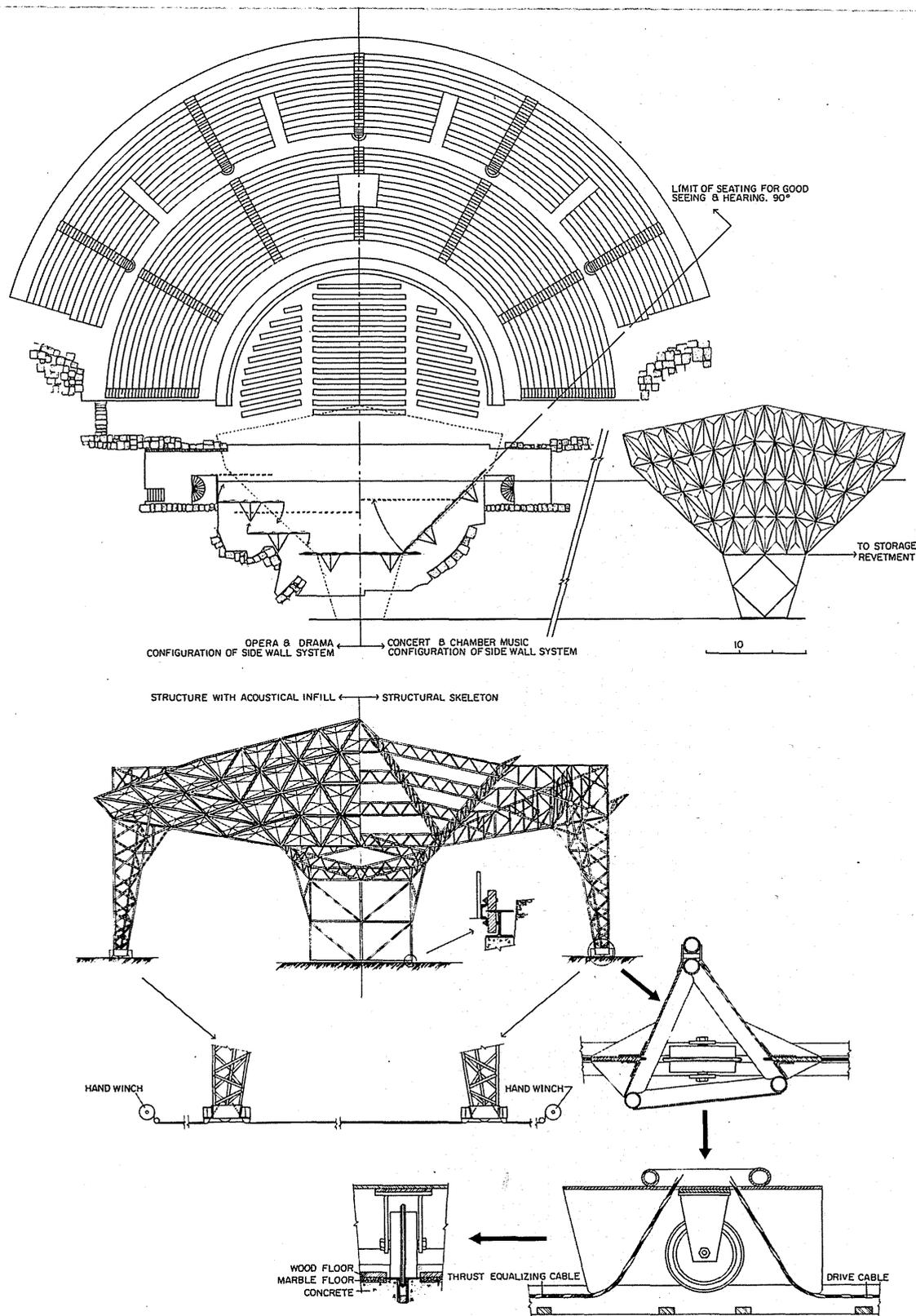
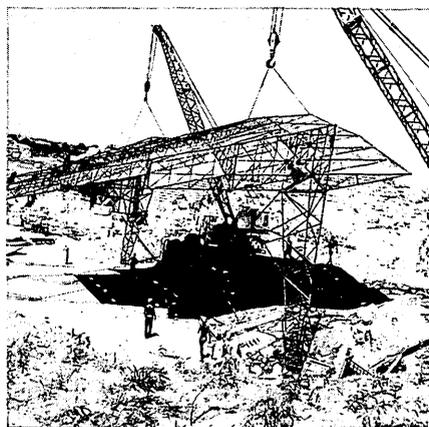
As the aerial photo (below) indicates, the Roman stage instead of the orchestra is being used as the performing area. The seating system has been restored with precast concrete panels of the same size and shape as the original masonry using rubble taken from the site as aggregate. The ancient masonry of the stage and its environs has not been disturbed. The canopy straddles the ruin. The sidewalls pivot and fold and when not in use the entire assembly is tracked off stage right and hidden. In this photograph 95 per cent of the contemplated restoration work is completed and the shell is in playing position.

V. Braun





The canopy was fabricated, assembled and erected on the site. It terminates in three legs and as the details (below) indicate it runs on four wheels in two tracks, one set into the stage and the other in a drainage ditch behind the stage. The canopy space truss and front legs provide lateral arch action, the thrust of which is taken by a cable drawn taut between the legs at each wheel in the slotted stage track. Movement on and off the stage is effected by manual winches at each end of the track.



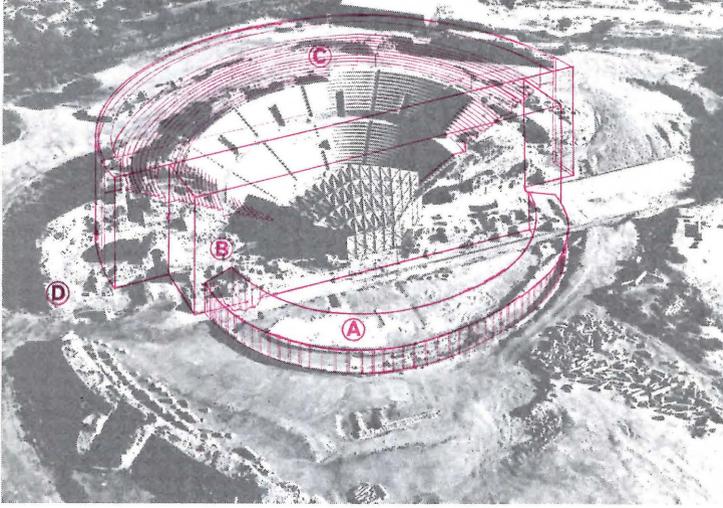
lem. Acoustical measurements taken at the site indicated only one practical approach, namely, to increase the signal-to-noise ratio by raising the energy delivered to the audience. Screening out the ambient noise would not be practical, is rarely if ever successful, and is usually impossible of attainment in outdoor auditoria.

The final solution

The fact that the structure had to be movable and retire to a position off the stage and out of sight was another problem high on the list of priorities, with the added restriction that the remaining ancient masonry of the stage and its environs was not to be disturbed. A number of schemes were hatched and abandoned until we evolved the idea of a canopy structured so as to straddle the ruin, mounted on flanged wheels which tracked off stage right for some 330 feet into a low hill adjacent to the original excavation. At my suggestion the hill was re-vetted for the purpose of hiding the canopy when it was not in playing position.

The canopy was built in Israel of weathering steel, exactly as designed. Structurally, it is a two-way space truss shaped like a great kite. The geometry consists of a series of small triangles which form larger triangles. The large center element is isosceles with small isosceles infill. The flanking arrays—right and left—are large right triangles with small right triangle infill. The skeleton is fabricated of 1½- and 2-inch weathering steel pipe with convex tetrahedra as the acoustical infill fabricated of 18-gauge dampened weathering steel. The canopy terminates in three legs, and runs on four wheels in two tracks, one set into the stage, the

The aerial photograph (below) shows clearly the canopy and the portion of the site which has been restored. The red lines imposed upon the photograph (right) show the extent of the ancient Roman theater. "A" is the colonnaded lobby behind the stage house, "B" indicates the stage house, "C" shows the limits of the seat bank (auditorium) and "D" the wall which is part of a Byzantine fortification which incorporated the theater and was constructed of masonry removed from the theater.



other in a drainage ditch behind the stage. The canopy space truss and front legs constitute lateral arch action, the thrust of which is taken by a cable drawn taut between the legs at each wheel in the slotted stage track. Movement off and on stage is effected by manual winches at each end of the track (one stage left and one located in the hillside revetment).

The shell is effectively closed from the edge of the canopy to the stage floor right, left and upstage by three-fold pivoting side wall units (six in total), which when folded and pivoted form either a modulated reflecting surface for music or a wing stage for dramatic presentation. They resemble the triangular pieces of machinery of the ancient Greek and Roman stage as described by Vitruvius. These are also fabricated of 1½ inch pipe and dampened 18-gauge weathering steel. The weight of the side walls total seven tons. The canopy weighs 22 tons, which includes its own lighting system, designed by Mr. Adar.

The results achieved during the incomplete 1968 and full 1969 seasons have been most gratifying. The musicians hear themselves without difficulty, and the acoustical field strength for music or voice, grounded in the audience has been doubled over previous experience without the shell. Quite apart from the fact that the structure works for modern means and contemporary audiences, there is one observation of interest to scholars of the ancient theater as well as to contemporary designers and acousticians concerned with modern theater design. Scholars have long insisted that the low stage house of the Hellenistic theater represented a great acoustical improvement over the older Greek theater of the

Classical Age. The claim is made that many of these stages were either built entirely of wood or had wood infill which then became a sounding board which was supposed to assist or to amplify the voices of the actors. These opinions were, I am certain, arrived at sans measurements and were aided and abetted by later seventeenth, eighteenth and nineteenth century theoreticians who had swallowed the bait cast by Vitruvius. It is interesting that the literature records no opinion concerning the acoustics of the ancient theater by a reputable scientist until almost the turn of the twentieth century. The Caesarea festival of 1968 provided the opportunity to test these phenomena. The shell was supposed to be completed by July 30 for the first concert of the 1968 season, but due to the student riots and accompanying labor strike in France the sheet steel for the infilling of the shell was not delivered in Israel on time. But the show had to go on and at the last minute it was decided to use the side walls which compare favorably in height to the early Hellenistic stage and which were structurally complete but were not infilled. They were temporarily infilled with half-inch plywood and used without the canopy. The first concert was somewhat exceptional due to the large forces consisting of chorus, soloists and symphony orchestra. The acoustical ambient due to wind and surf was up to measured average and disappointment was complete. The field strength and the resulting signal to noise ratio showed virtually no improvement over that with no side walls, and electro-acoustic reinforcement had to be used. And because of the size of forces employed the musi-

cians experienced greater than usual difficulty in keeping together. A concert of chamber music ten days later was somewhat more successful and got by with a minimum of electro-acoustical help but on this evening hardly a breath of air was stirring and there was no surf which bears out the previous contention of wind action. This condition of ambient quiet is similar to what I have measured in ancient theaters at inland sites like Aphrodisias in central Turkey and other isolated locations where low ambient is the rule, which demonstrates that above all else this is the essential criterion required to make an ancient theater work acoustically.

The missing steel arrived. There were now three weeks in which to finish fabrication and erect the moving canopy in time for the final concert of the season—the New York Philharmonic with Leonard Bernstein conducting Mahler's Fifth Symphony. The structure was finished barely twenty hours before the concert and I was asked if we would need the electro-acoustical reinforcement system. I answered in the negative and it was forthwith removed. We hoped for a repeat of a quiet night but it was not to be and the measured ambient was back up to its normal level of wind and surf. But by this time the preliminary measurements had given me enough confidence that I was certain of the result. The big moment had come and all of us were full of expectations and so it happened. The canopy made all the difference—and ray diagramming for the first reflections tells the whole story. The combination of steel side-walls and canopy in the sending end with the steep Roman seating system in the receiving end gave us the best of

both worlds, modern and ancient. The direct sound and reflected sound arrive within about 30 milli-seconds for virtually all seats—even the ones high up and to the sides which in the reconstruction were purposely limited to the 90 degree spread of the shell. The instrumental balance was exceptional for outdoor auditoria. There are no foci for any of the more than 3,300 seats due to the non-curved geometry of the shell. One other feature should be mentioned. Leo Beranek, Robert Newman and their colleagues have coined an excellent term for musical acoustics in the open air which they describe as "running loudness". This simply means that if there is enough energy and if it keeps coming, the sound is large and full bodied. The fact that there is no natural reverberation in the outdoors is because there are no natural return energy paths beyond the first reflections. It would be interesting in this instance, because of the excellent direct and first reflected energy, if reverberation were to be added by electro-acoustical enhancement. This enhancement should not be confused with electro-acoustical amplification, a necessity before the shell was built. If this should ever be accomplished we will have come full circle and provided for the first time in an ancient theater a reverberation system of the proper interface that works in lieu of the Vitruvian sounding vessels of legend.

THE FESTIVAL THEATER, Caesarea, Israel. Owner: *The Israeli Government Department of National Parks—Yaacov Yannai, director*; acoustical, structural and mechanical design: *George C. Izenour Associates, Inc.*; associate designer: *Arnon Adar, Tel Aviv, Israel*; construction engineer: *Gideon Kreiser*; supervising engineer for Department of National Parks: *David Kissin*.

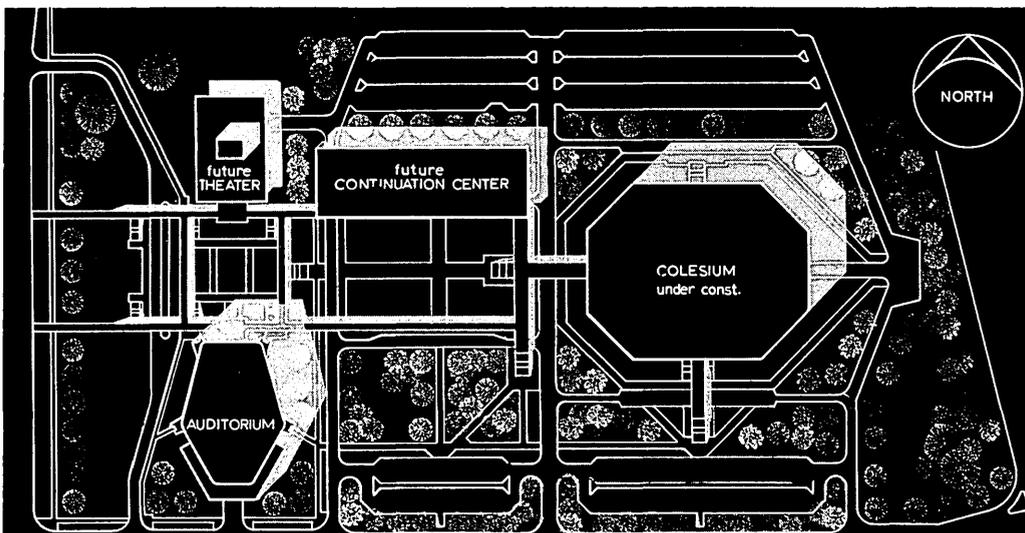
IOWA'S PRAIRIE AUDITORIUM

The new C. Y. Stevens Auditorium at Iowa State University is a free-standing piece of sculpture in a rolling gentle setting, full of grass and trees. It is refreshing to note that such architecture still is being commissioned, and that some architects get to occasionally practice architecture as it once was taught—when we believed there would always be grass and trees around buildings, cities and people.

The new theater sits on the eastern edge of the old campus in a new group of buildings called the Iowa State Center, and it is the first of the group to be completed; Crites and McConnell, Brooks, Borg and Skiles are the joint venture architects. The structure was designed to be successful

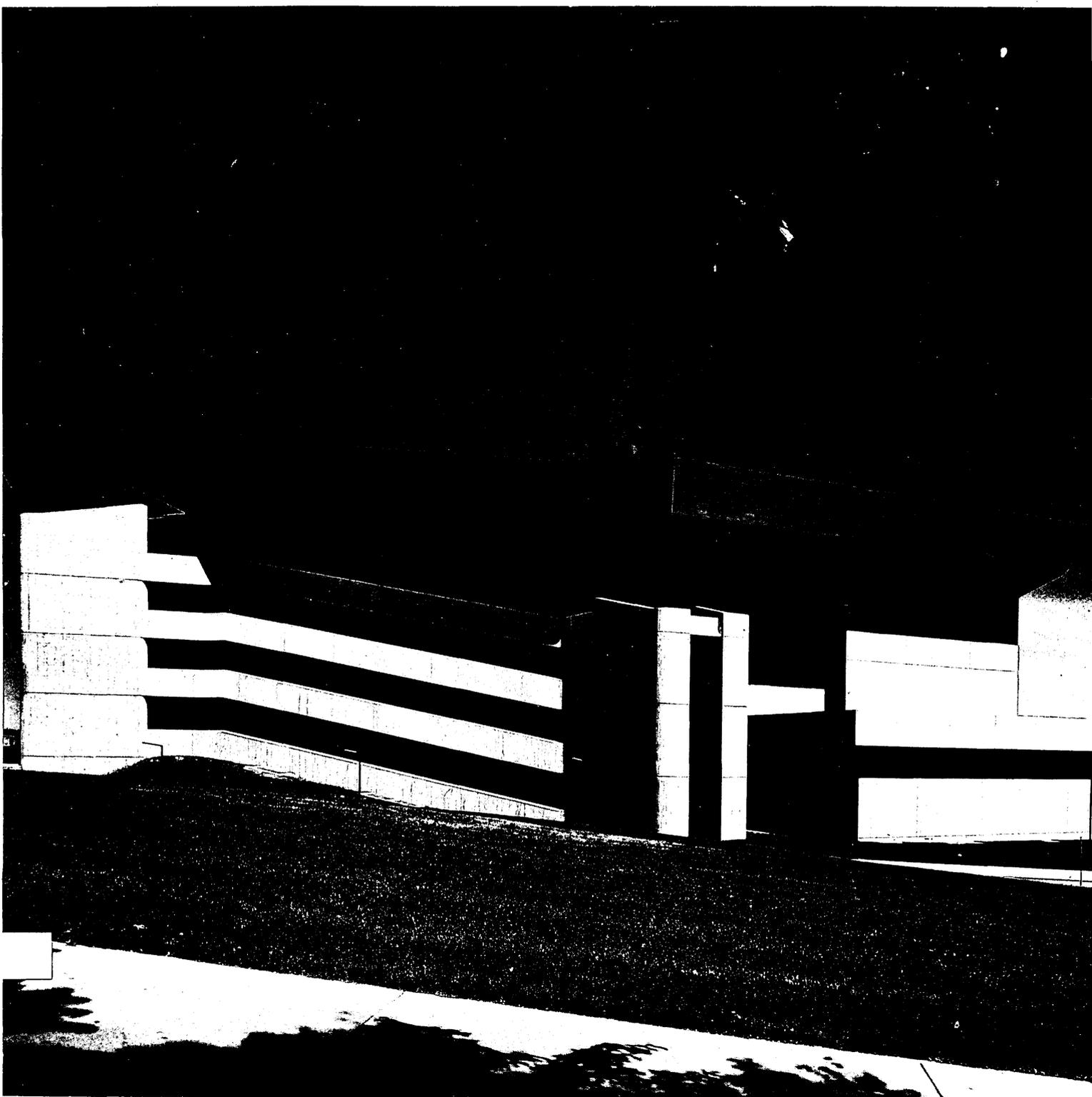


Julius Shulman photos



either as a theater for live stage productions, or as an auditorium for speeches and symposiums. The problems of acoustics, and of site lines from seating to stage, are crucial in both kinds of functions, and the building should be seen as a simple, direct, powerful solution to both problems. The exterior follows directly from the spaces inside.

In section (page 78) the auditorium is shown to have about twice the rise in its seating from stage to rear as "normal" auditorium seating provides. The rise between rows is 4 inches near the stage, increasing to 12 inches at the rear of the floor. The three balconies above, and their accompanying side balconies, are even more sharply sloped, as the section shows. The



clusion of three balconies, plus the strong slope of the seating has reversed what is often the high end of a theater: the stage end with its space for flying sets. This space is accommodated in the Stevens Auditorium within the general roof height itself.

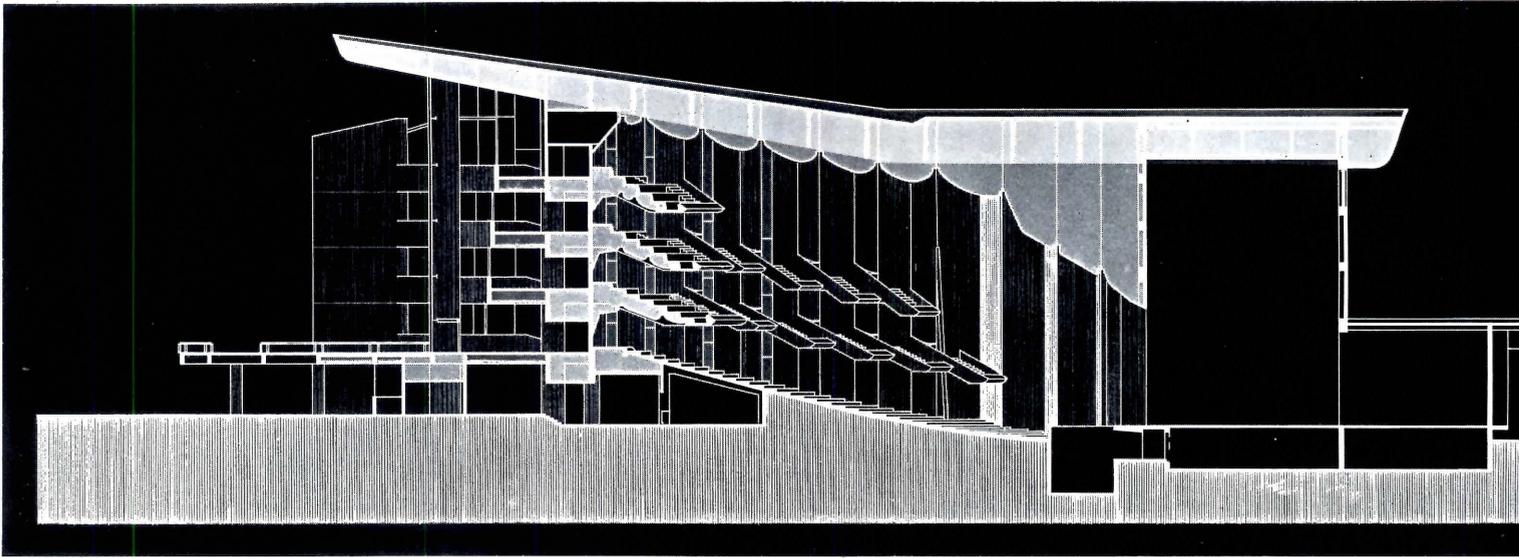
The scalloped interior ceiling, and rhythmic stepped pattern of the sidewalls are architectural responses to acoustical needs, determined by the architects, and by the acoustical consultants, Paul E. Venekisen & Associates. Sounds emanating from the stage are properly resonated and mixed through these shapes, and through the material of the surfaces themselves. The principal interior material is poured-in-place concrete, board-formed and left untreated

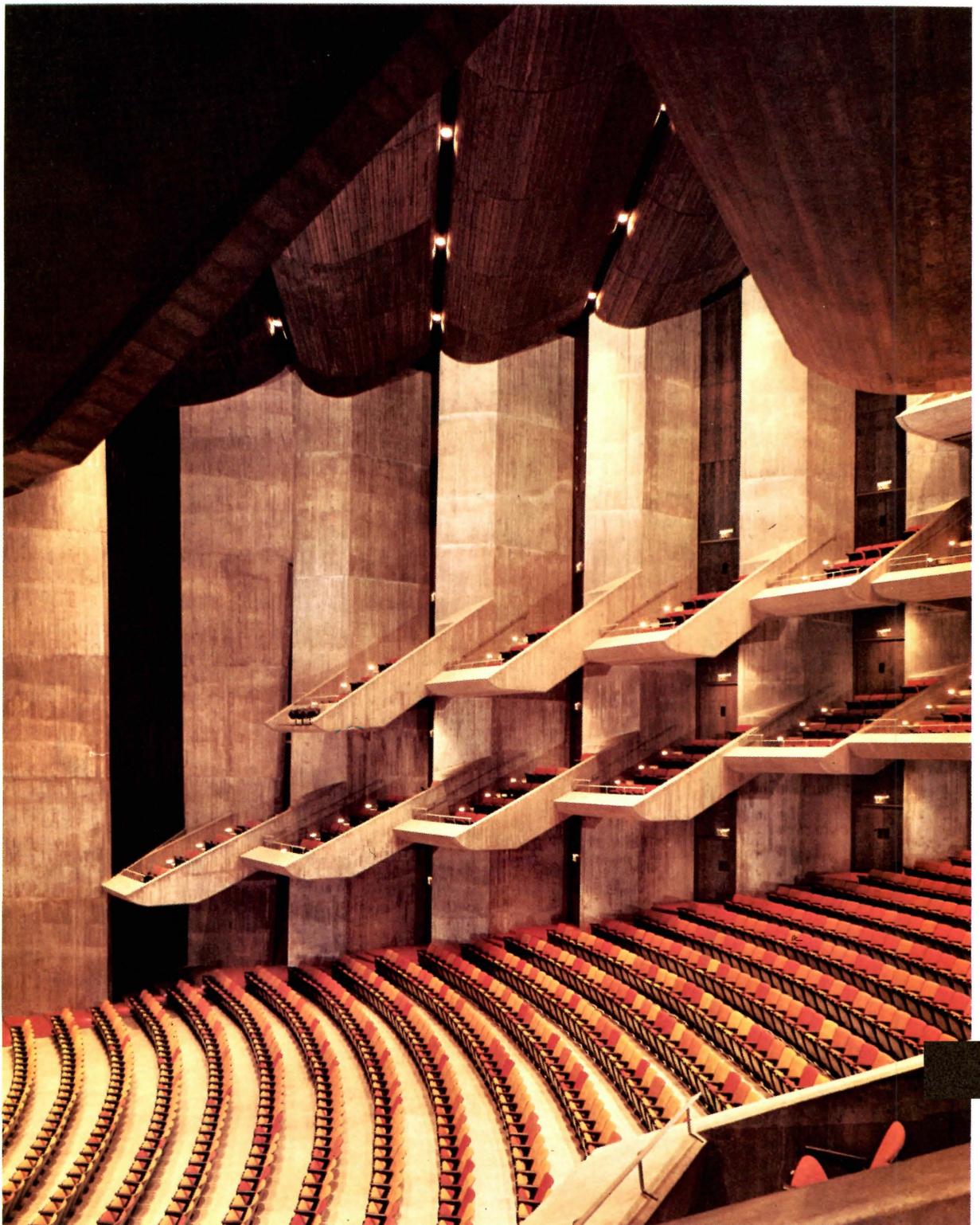
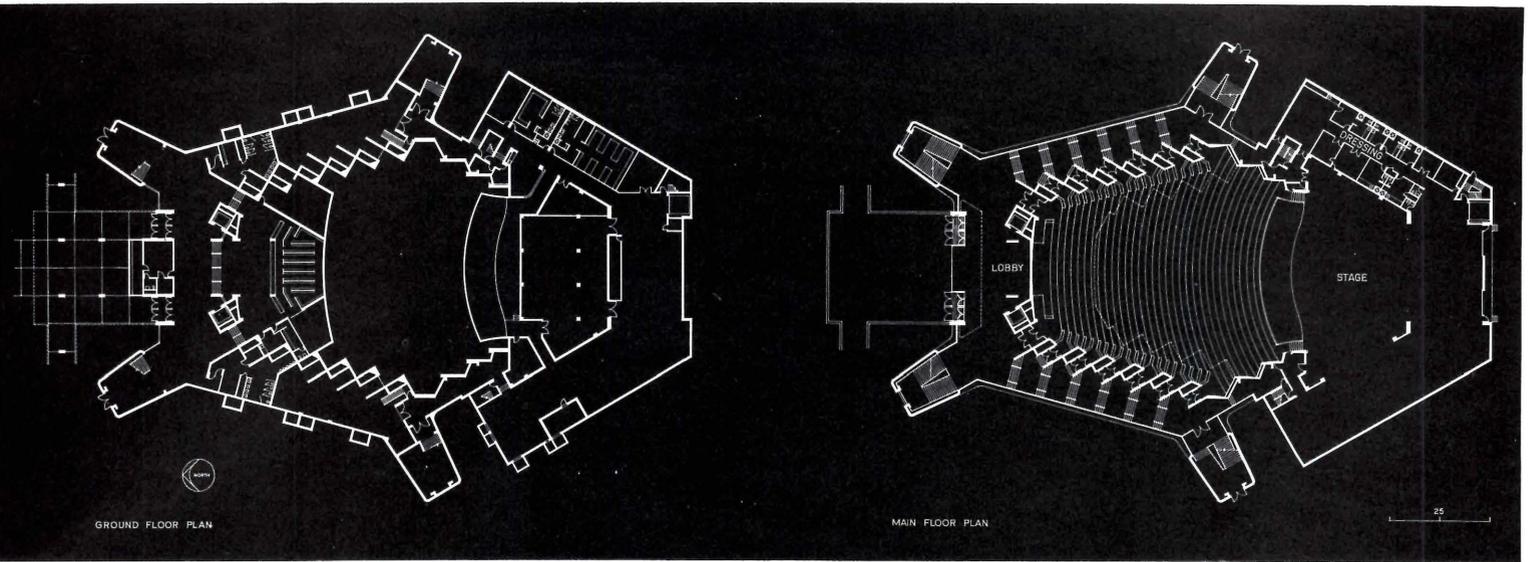
after removal of the forms. Carpeting on the floor and fabric on the seats help baffle crowd sounds, and a system of drapes can be adjusted to provide greater or less sound absorption near the stage. The vertical aisle partitions between concrete piers are oak, and the scalloped auditorium ceiling is larchwood boards three inches thick. Larchwood was picked over cedar (which is the exterior soffit material of the roof) because of its greater density, and thus better acoustic characteristics in this application. The seating pattern is continental, as these photographs show, with no center aisle and with each row far enough apart for easy circulation between them.

On the exterior the major exposed ma-

terial is again poured-in-place concrete, along with the exposed cedar over the roof soffits, and the dark glass between stair ramps. The easy stairs are simply expressed as nearly horizontal concrete bands on the exterior, with glass between them, and each ribbon terminates in the stair towers into which they empty. There are two entrance levels at the front of the auditorium/theater, one at ground level and one at the main floor level, which meets the exterior set of overhead walkways and plazas connecting all the buildings of the Center. Many of the walkways are in place now, so that the building seems to be reaching out with giant arms toward the land and the people around it.







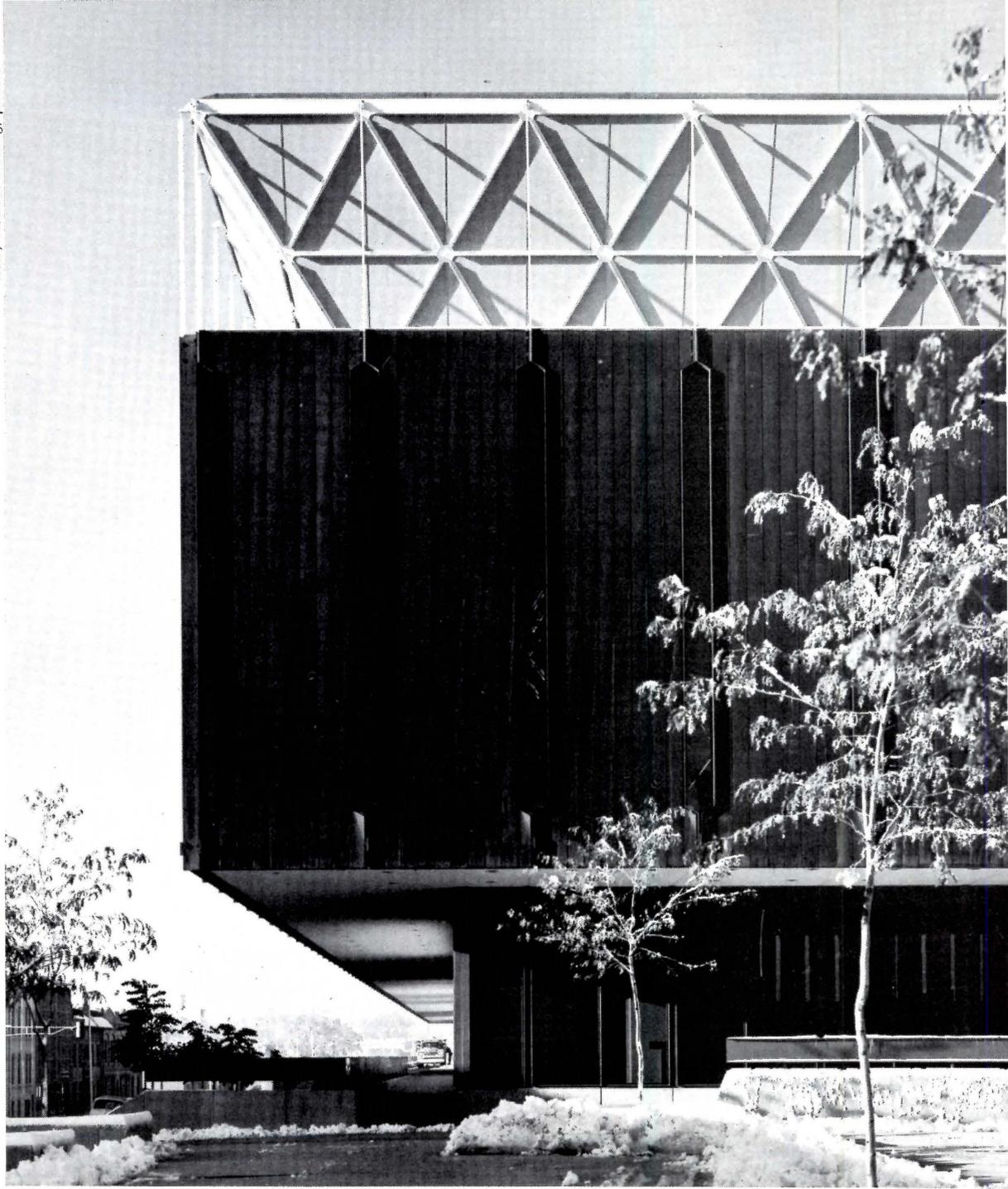
The roof is supported on the series of hollow concrete piers which surround the main space; these also carry hot and cold air. The roof is framed out in steel, with special girders spanning between piers, then standard bar joists, metal deck, and built-up roofing. Heating and cooling is provided from the university's central plant, eliminating the need for mechanical spaces, and possible sources of noise and vibration. The orchestra pit is equipped with a hydraulic lift; if needed the platform can be raised to stage level to provide additional working areas. There are four individual dressing rooms for stars, two large chorus rooms, and an actors' lounge backstage, along with ample room for scenery.

The whole theater, with its 2,637 normal seating capacity, cost under \$5 million to build. That is a good price for a theater these days. With its careful proportioning and the direct, simple exterior expression of how it works and what it is, the Stephens Auditorium is very much in the first rank of modern architecture in the Midwest. We still have room to do buildings like this in some places, and it's rewarding to find them done well.

—Robert Jensen

C. Y. STEPHENS AUDITORIUM, Iowa State University, Ames, Iowa. Architects: *Crites and McConnell; Brooks, Borg and Skiles*; joint venture. Acoustical consultant: *Paul E. Veneklasen & Associates*; general contractor: *Martin K. Eby Co.*

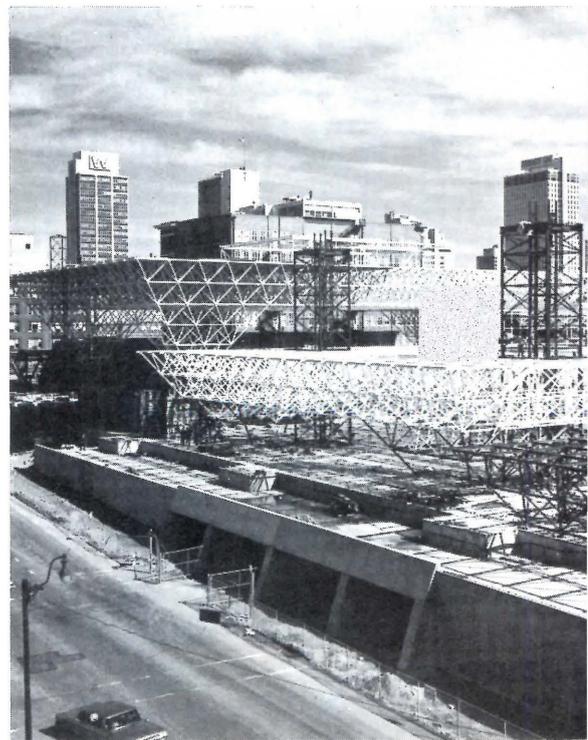
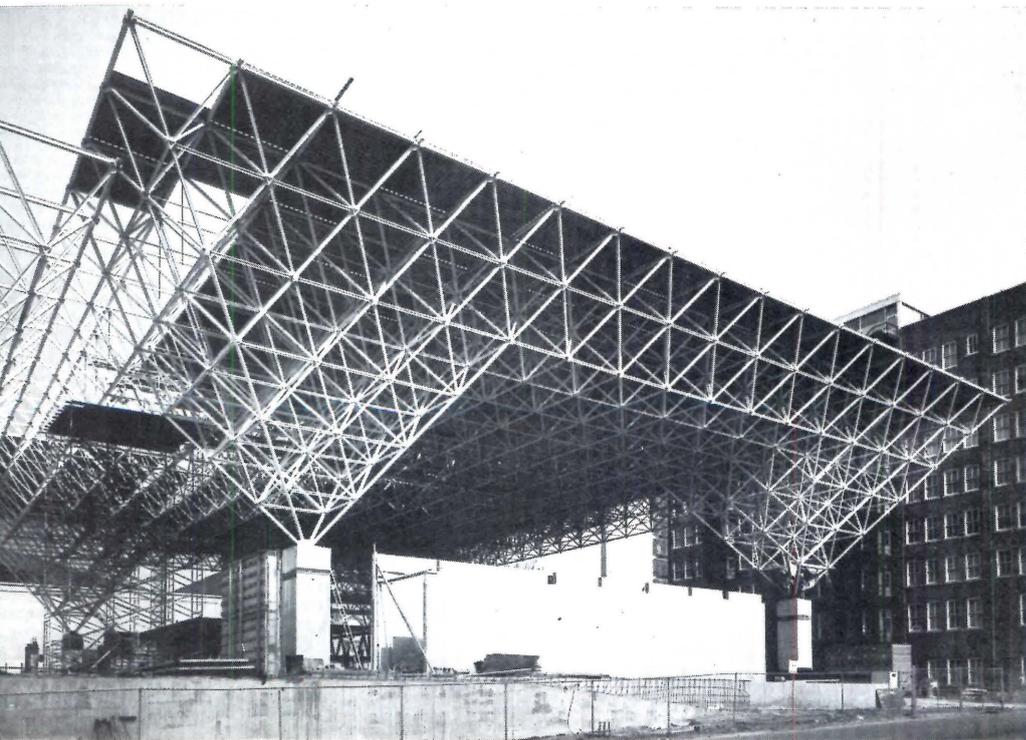


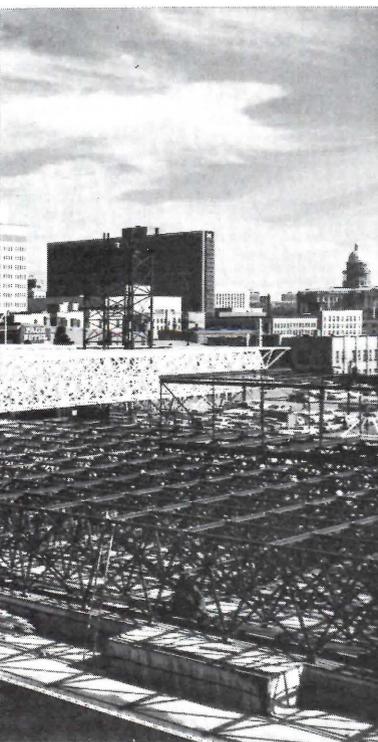


CURRIGAN HALL: A CONCEPT OF SIMPLICITY FOR A BUILDING OF COMPLEXITY

Denver's Currigan Hall, a major new exhibition and convention center, is many things simultaneously: its architects have joined in joint venture to create a strong, clear, exceptionally handsome architectural expression, a bold simple structural solution, and a building that competes with the best of its field for the business which is its livelihood.

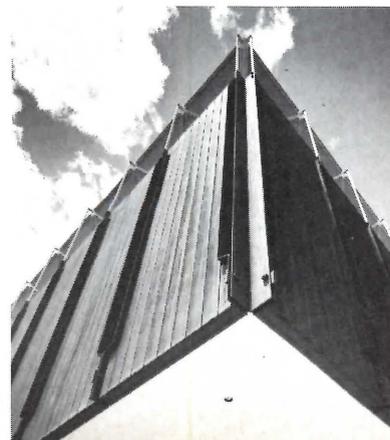
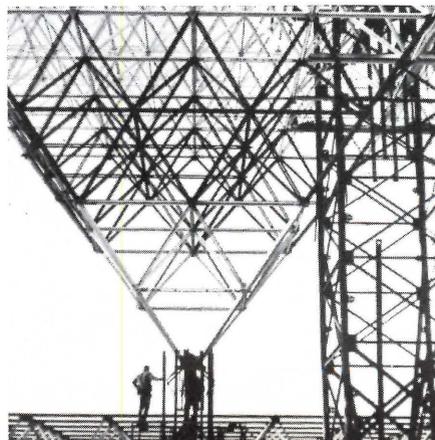
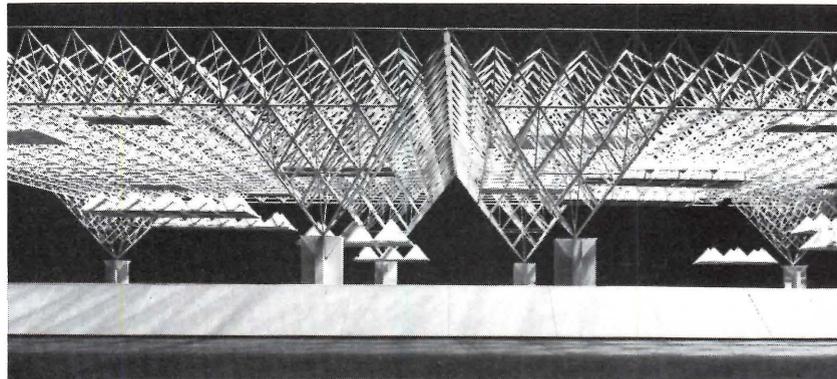
CURRIGAN EXHIBITION HALL, Denver, Colorado. Owner: *City and County of Denver*. Architects: *Muchow, Ream and Larson* (joint venture); *Karl Berg, George Hoover, Edward Tower*, development team. Engineers: *Ketchum, Konkel, Ryan & Hastings* (structural); *McFall & Konkel* (mechanical); *Swanson-Rink & Associates* (electrical). Contractors: *Burkhardt Steel Co.* (space trusses); *F. R. Orr Construction Co.* (general).

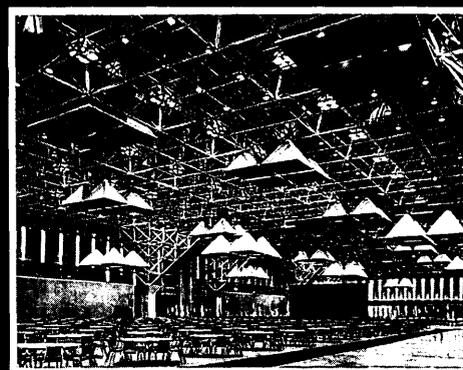
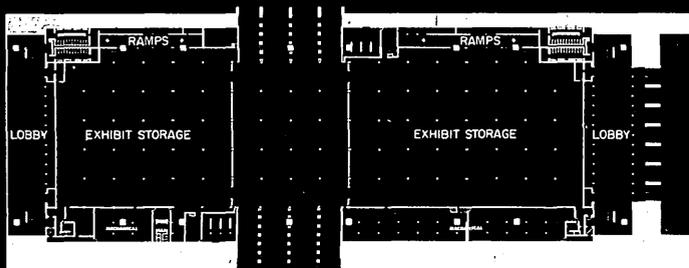
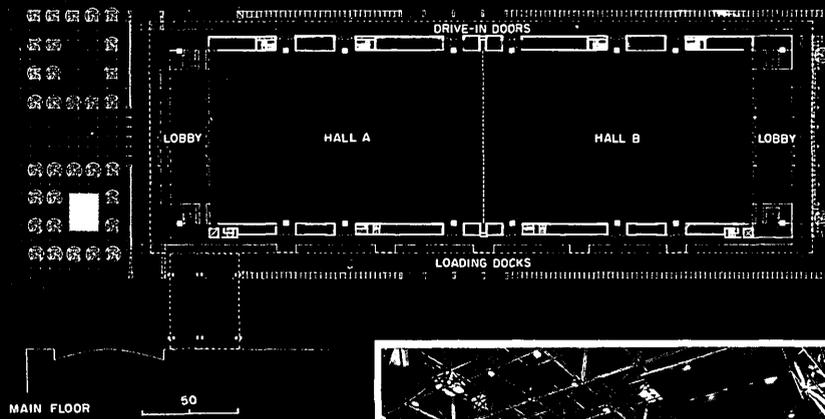
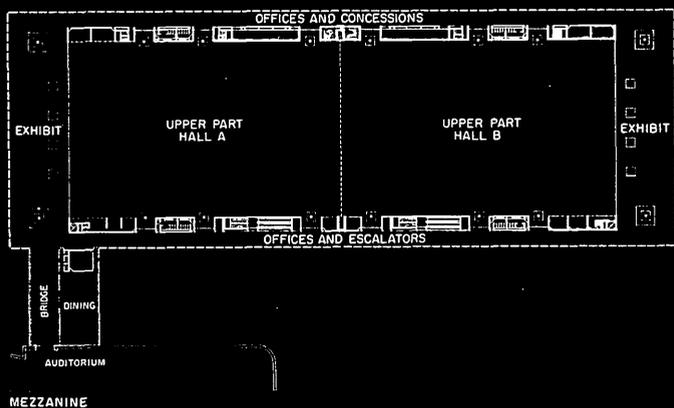
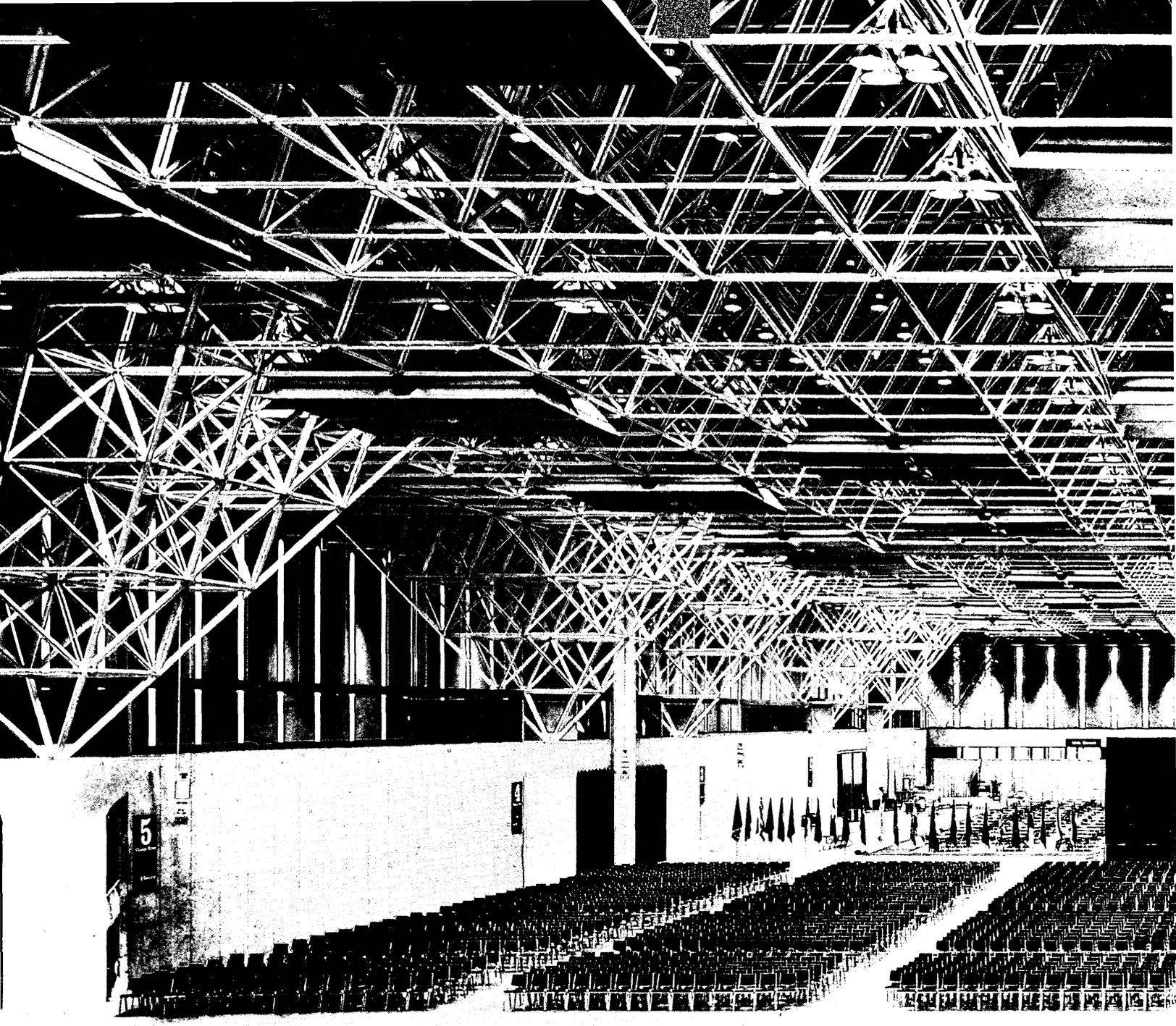




The space frame is the dominant feature of the building, architecturally and structurally, providing a surprisingly light (13.2 psf) and economical (\$7 psf) roof system. The frame is a two-layer, three-dimensional system of inclined double Warren trusses, in which all members (24,000) are the same length (10 feet) and all joints (6,000) are a standard detail (but of special design: each is made up of three intersecting octagonal planes, accommodating up to 12 members). The 680 by 240 foot roof is in four sections, each 170 by 240 feet, supported by inverted pyramid columns which rest on five-foot-square concrete columns. The frame was assembled on the building floor section by section and raised in three phases, allowing, in the first phase, for attachment of the pyramid columns; in the second phase at 21 feet above floor, for placement of steel pipe columns at the four corners and pouring of concrete columns; and finally for positioning on these columns at the ultimate height of 46 feet above floor. Each section supports a massive mechanical penthouse containing transformers and cooling towers.

Currigan Hall is large—685 by 240 feet in size, with 100,000 square feet of clear-span exhibit space—but more impressive than its size are the simplicity of its concept and its quality of serenity. Structure and architecture work together to provide the required long-span space and to permit variations in scale, from the monumentality of the building itself to the 10 by 10 foot module of the individual display space. This concept, of huge building within which certain areas can be scaled down, won a statewide competition for a joint venture of three Denver architects, each of whom assumed specific responsibilities for the job: W. C. Muchow, administration and coordination; James T. Ream, design; Dayl Larson of Haller & Larson, production and supervision. The space frame which is so important a feature of the interior is also an essential part of the exterior, visible as the roof structure and as the support for the exterior walls which hang from it. As ceiling of the exhibition floor, it is visible from outside because of the "picket fence phenomenon" produced by the repetition of the slit windows at regular intervals along the exterior walls. To a viewer in motion, the walls appear transparent so that he sees the lacy frame as he moves past even though he is conscious of the walls as walls. The windows are tall narrow openings (18 inches by 30 feet) between the panels of weathering steel (10 by 30 feet) which make up the exterior wall. The light weight of the steel panels was important in their maintenance-free characteristic and their rich color. There are three floors: Basement with limited parking, some storage and mechanical equipment; main exhibition floor, and mezzanine which overhangs the sidewalk and straddles a street.

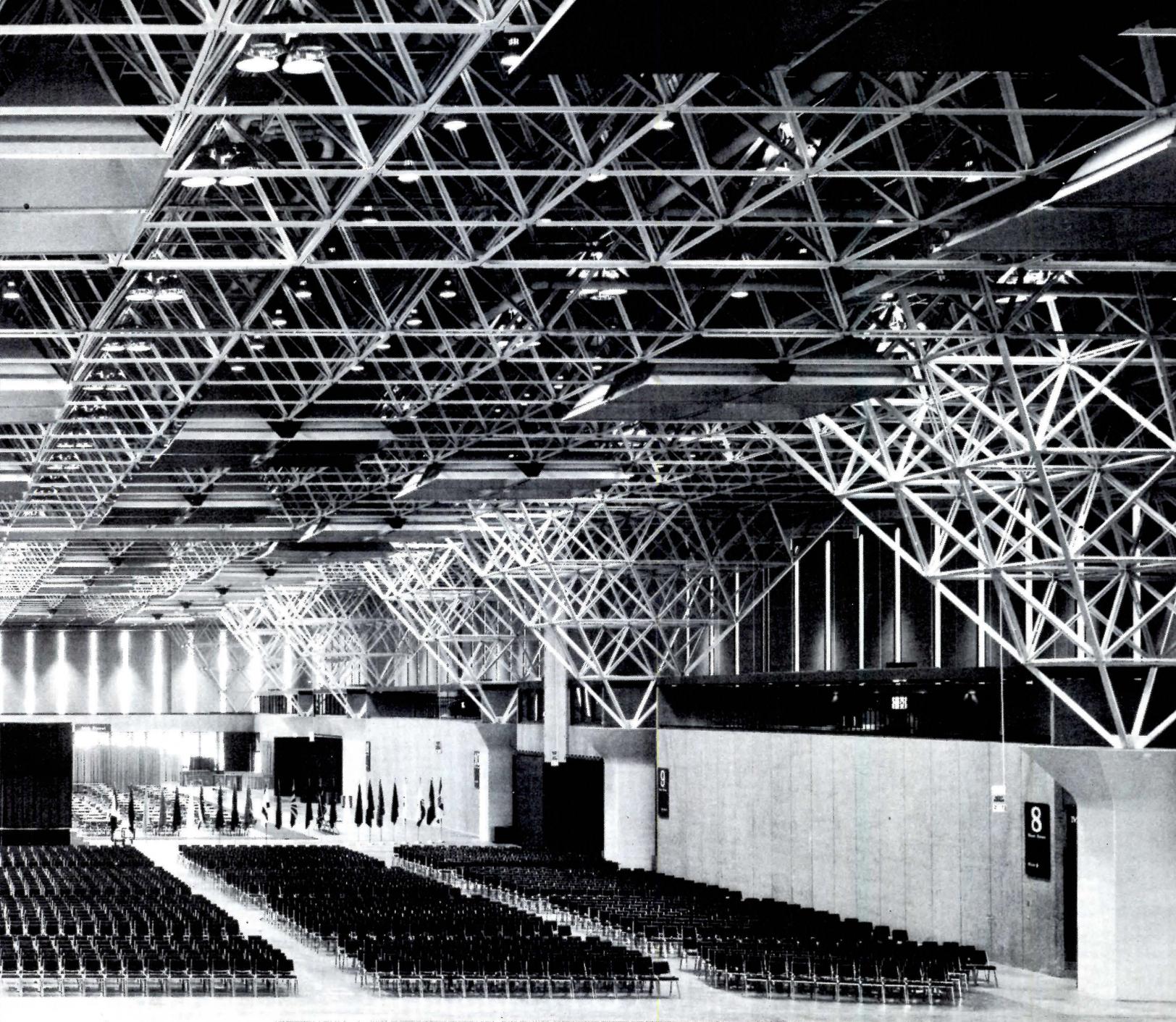




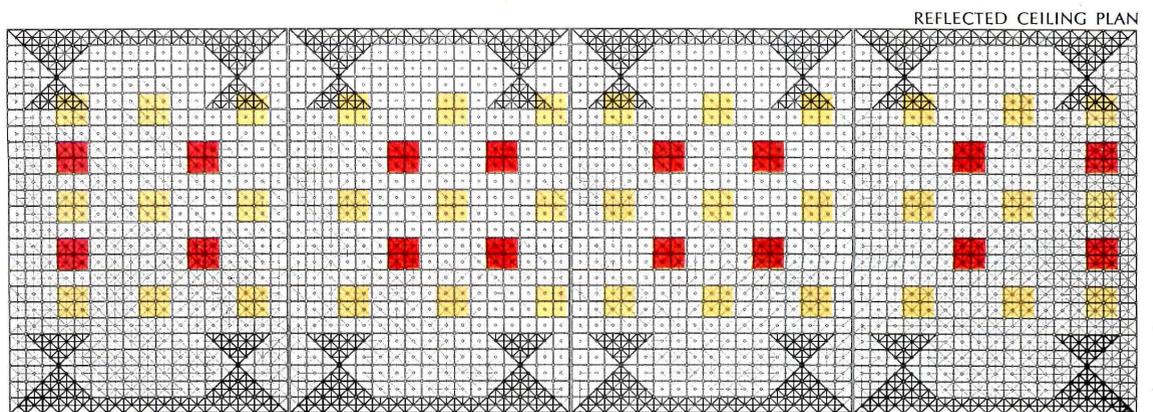
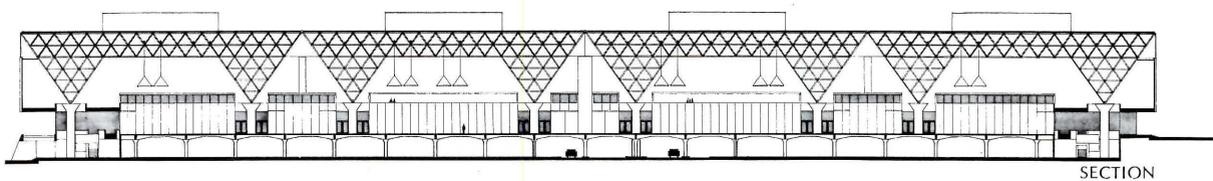
LOWER FLOOR

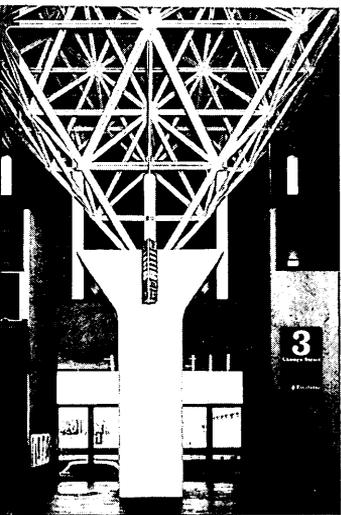
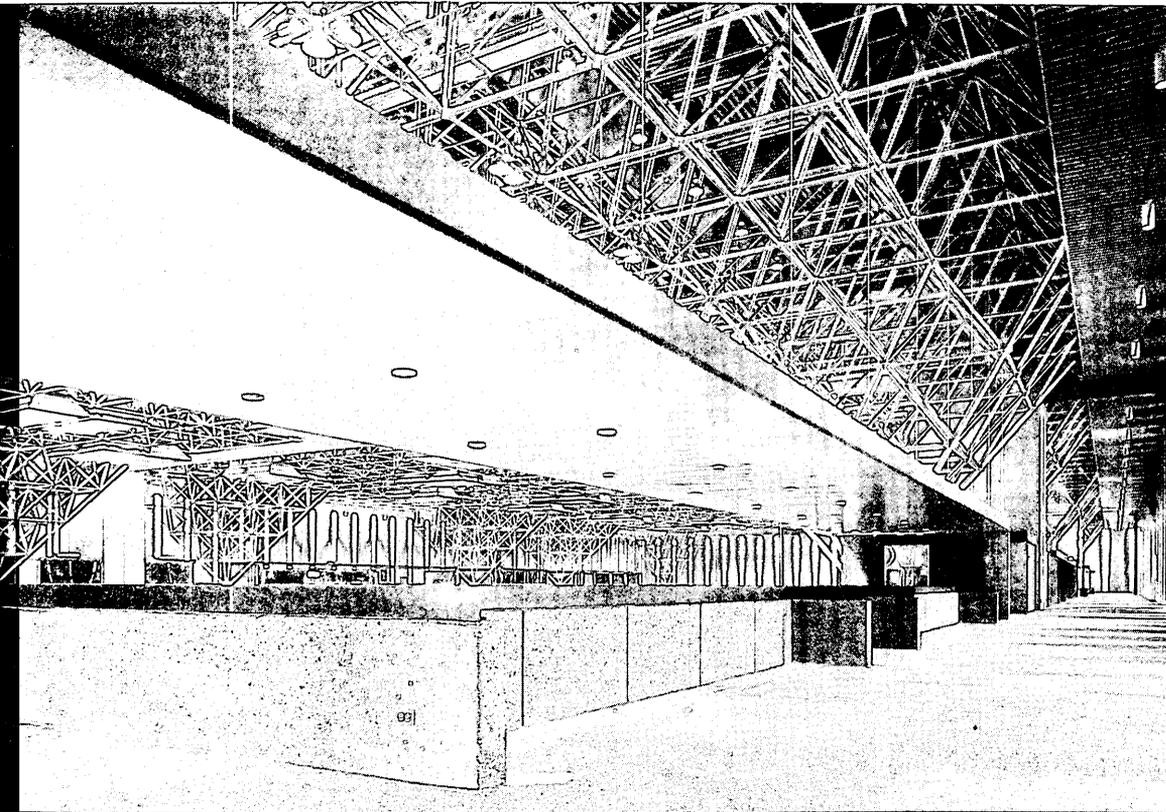
MAIN FLOOR

MEZZANINE

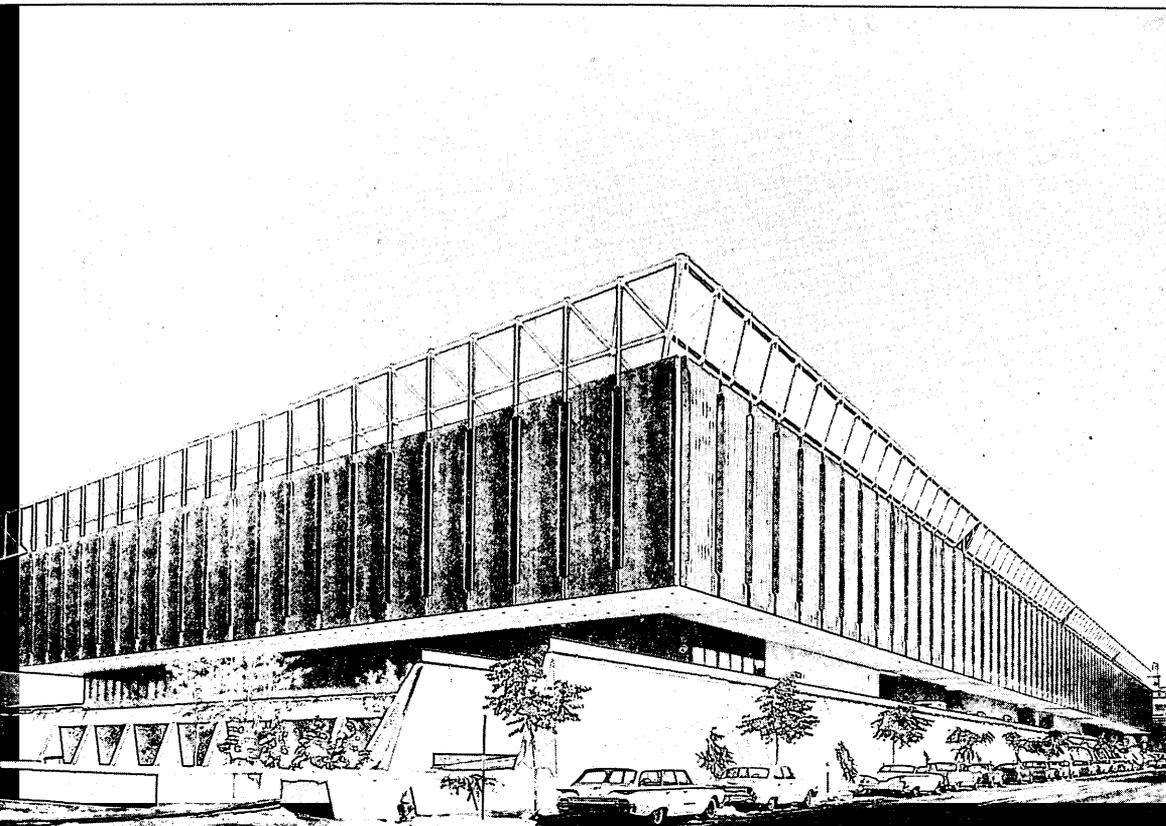


The colorful pyramids that hang from the truss of the space frame are unique assets of Currigan Hall. They form an adjustable ceiling system (see reflected plan at right) designed to vary the scale of the vast interior by providing a canopy of suitable (and variable) height over each module of display space. Each pyramid contains lighting for special high intensity illumination. Pyramids can be lowered singly or in groups and, when not in use, nest in the grid of the space frame. The prismatic forms of these pyramids, and their colorful interior surfaces (red or yellow), seen against the web of the space frame, make "visual pageantry of the long perspective of the hall," to quote James Ream, partner in charge of design. The space frame, painted white, seems even lighter than it really is and the pattern of its thousands of members is a visual maze of extraordinary vitality. For daytime events, daylight from the slit windows adds to this sense of liveliness. The exhibition hall has been designed so that it can be divided at its mid point for smaller events; and the ceiling system can be adjusted to provide a lower over-all ceiling height.





The key to the economic success of an exhibition-conventional hall is its operating efficiency, particularly its provision for moving goods and people. Currigan Hall is exceptional in its handling of both. Trucks proceed from the street by ramp (there are two, one on each side of the building as photo at right shows) direct to the exhibit floor, unload under cover at any of 12 drive-in positions along one side or nine dock positions on the other. Loading and unloading (and even crate storage) is all horizontal, a considerable economy over vertical handling. People who enter on foot across landscaped plazas or by car from the ramps. A mezzanine level with lounges, rest rooms, offices and control booths, provides a spectacular view of the space frame, pyramids and the vast floor with its space for 14,000.

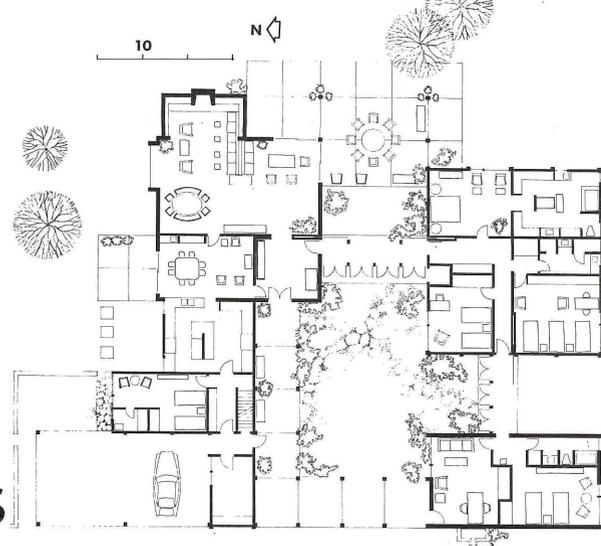


House facing the High Sierras

On an upland meadow south of Yosemite, architect John Rex and his family planned a house that serves as the nucleus of a working cattle ranch. The house rests gently on a carpet of wildflowers, and is built around an entry court landscaped in stone, gravel and tufted greenery. If the court is stylistically mannered, it is also conceived and executed with loving attention to detail. The specimen boulders, pitted and covered with lichen, were assembled from various locations around the ranch

and placed with evident care. Blocks of bedrooms on the south side of the court are linked to each other and the rest of the house by covered walks that are closed in winter and used as hothouses. In summer, these corridors are thrown open to a prevailing westerly that is funneled through the court to the covered terrace (see plan).

The living room, zoned informally for small and large groupings, opens to the north and southeast to frame wide-angle views of mountain and meadow. The



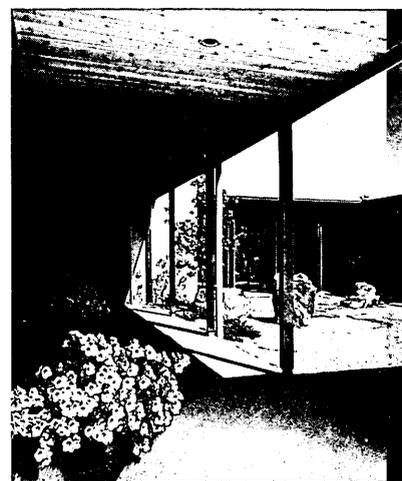
whole scheme is visually unified by a continuous flat roof that keeps the silhouette low and contrasts with the distant Sierras.

Principal materials are slump stone and resawn cedar inside and out. Floors are finished in custom tiles colored to match the surrounding soil.

RESIDENCE FOR MR. AND MRS. JOHN REX, North Forks, California. Architects: *Honnold and Rex*; engineer: *Greve & O'Rourke*; landscape architect: *Edward Huntsman-Trout*; interior design: *Guy Moore and Associates*; contractor: *F. D. Wilcox*.



Leland Lee photos



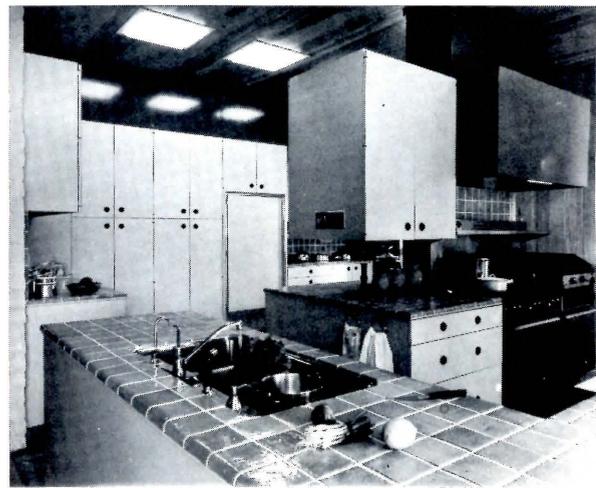
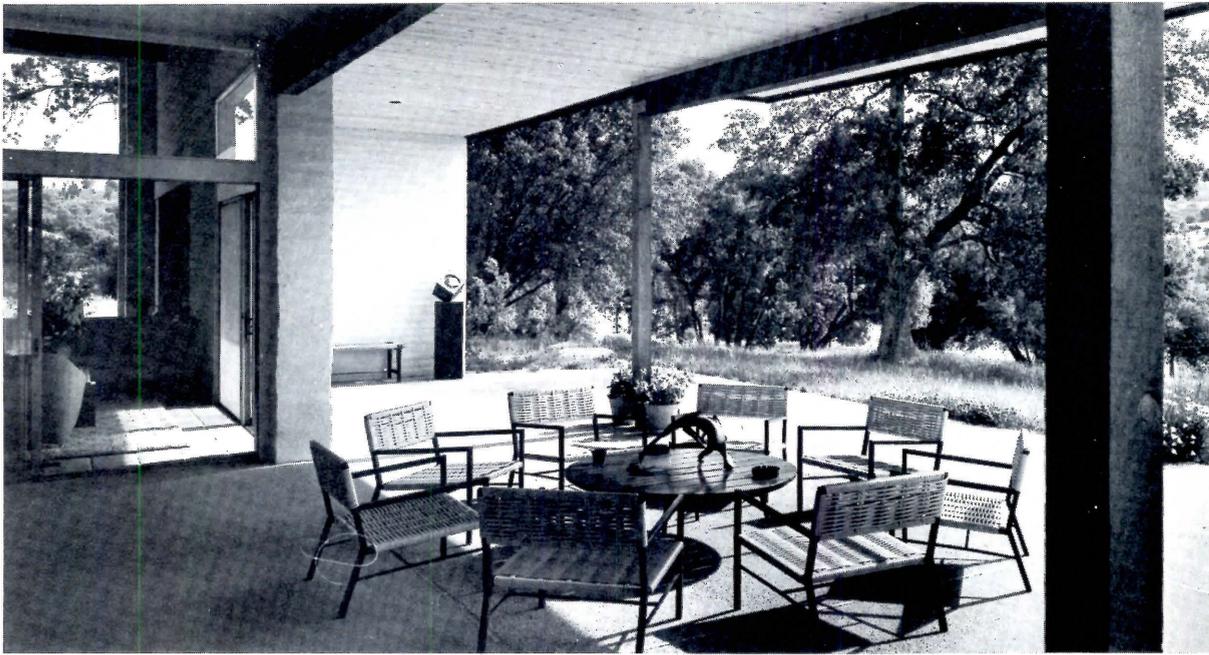
Entry court, designed to be contemplated rather than used, looks well from all angles and at all seasons. Rock and plant materials are all native to the ranch.





Living room sub-divides easily to accommodate groups of various sizes. A small alcove with its fireplace provides an intimate setting for winter evenings. Ceiling height is raised to 16 feet over the rest of the room and furnishes entertainment space at a grander scale. Couches are covered in cowhide and all accent colors are chosen to match local wildflowers that bloom in profusion each spring.





In the kitchen (above) which opens into the family room, meals can be prepared for as many as one hundred guests. Photo (below) shows corridor buttoned up for winter. Bedroom (left) has its own entrance and opens generously to a view of country once inhabited by Mono Indians.

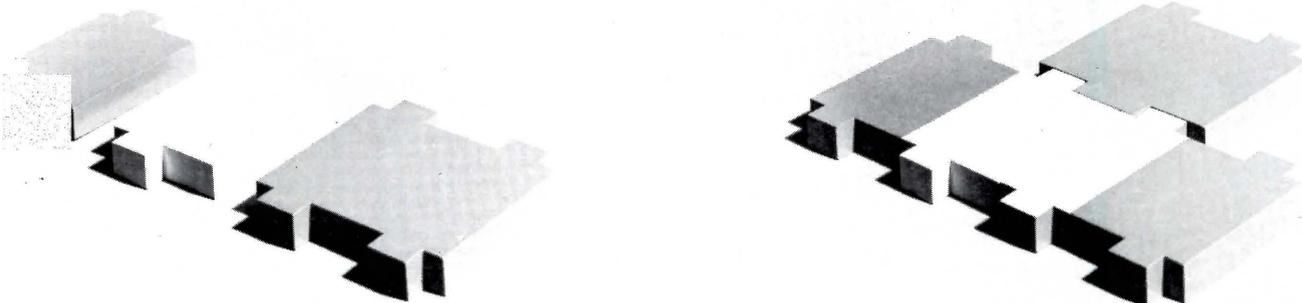


HOSPITALS

Hospital planning and design have faced two concurrent crises in this decade. The first crisis is in rising costs of both medical services and building construction. The second is a veritable social and technological revolution in which increasing pressures for national health insurance will, if successful, stress facilities for increasingly sophisticated medical techniques and radically change the mix of patients. Planners and designers are applying creative intellect to solutions of these problems. Four examples follow: 1) a new approach to design, 2) an analysis of possible effects of national health insurance, 3) a multi-discipline approach to regional planning, 4) a huge complex near London that deals realistically with a composite of all of these problems through application of John Weeks' "indeterminate architecture."

William B. Foxhall

Unit theory design: synthesis of the super-module



Unit Theory Design is a new method of hospital planning designed to save time and money, and improve results. It has developed steadily since it was first described at the January, 1970, Design Institute of the American Hospital Association by John V. Sheoris, design director of medical facilities, Smith Hinchman & Grylls Associates.

■ Unit Theory Design achieves the combined objectives of cost control and ultimate flexibility by bringing together and extending the effectiveness of several techniques currently applied to building design and construction. In simplest terms, unit theory design is a synthesis of concepts: the module (structural or functional), the systems approach, functional and mechanical flexibility, expansibility, and the "fast track" approach to programing, design and construction.

The result is development of a kind of super-module which has structural and functional characteristics unique to its own

sets of program and constraints but is of general applicability to the many kinds of space in the building. This super-module achieves the economies of repetition while it sustains for the unit theory practitioner a thoroughly architectural approach to building design—despite the constraints of codes and urgencies of time and cost control.

The block models shown above have been used to demonstrate one possible configuration and mode of assembly. The projections from the blocks represent certain repetitive fixed vertical elements, such as stairwells or mechanical chases (but not columns), between which distances are determined by codes or mechanical engineering considerations. The white blocks show a capability for partially overlapping and interlocking demi-modules (called additive units) to accommodate fractional space requirements without violation of either the basic structural system or the spacing of fixed elements. Illustrations on following pages show how these units evolve.

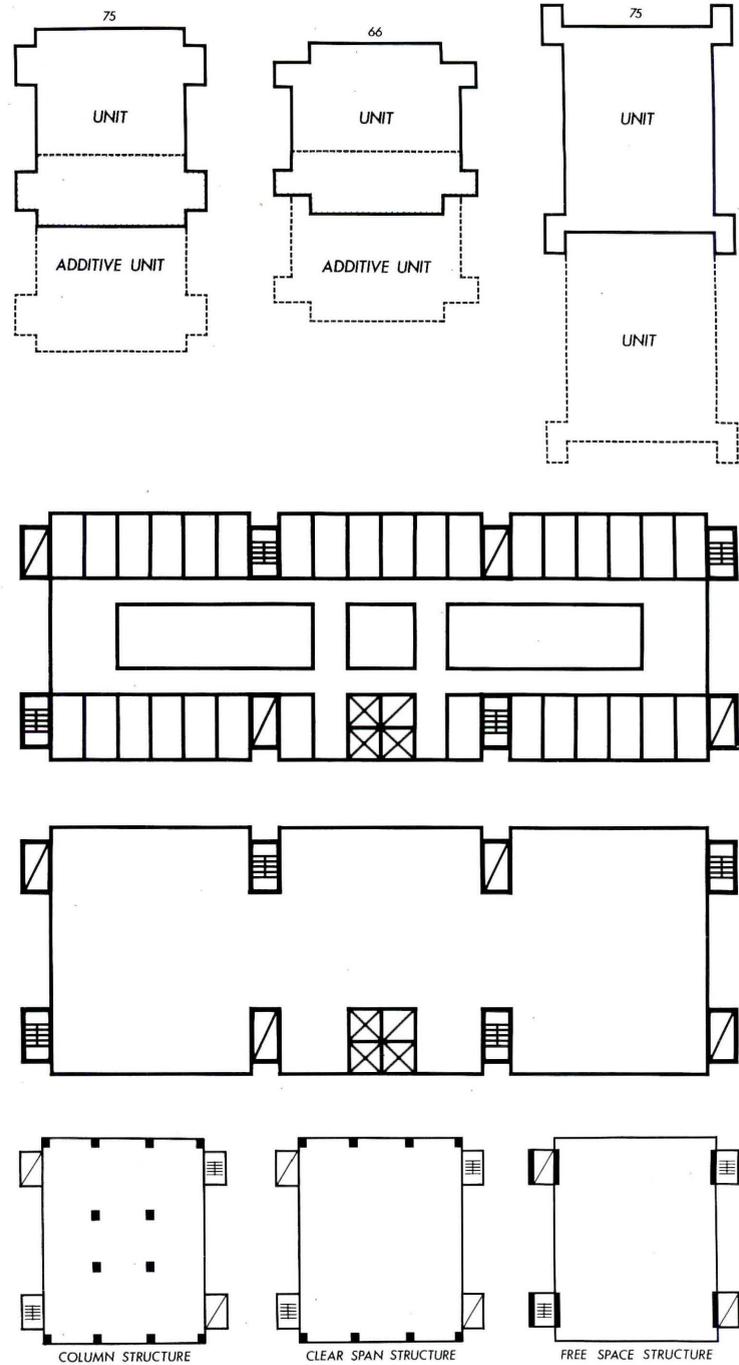
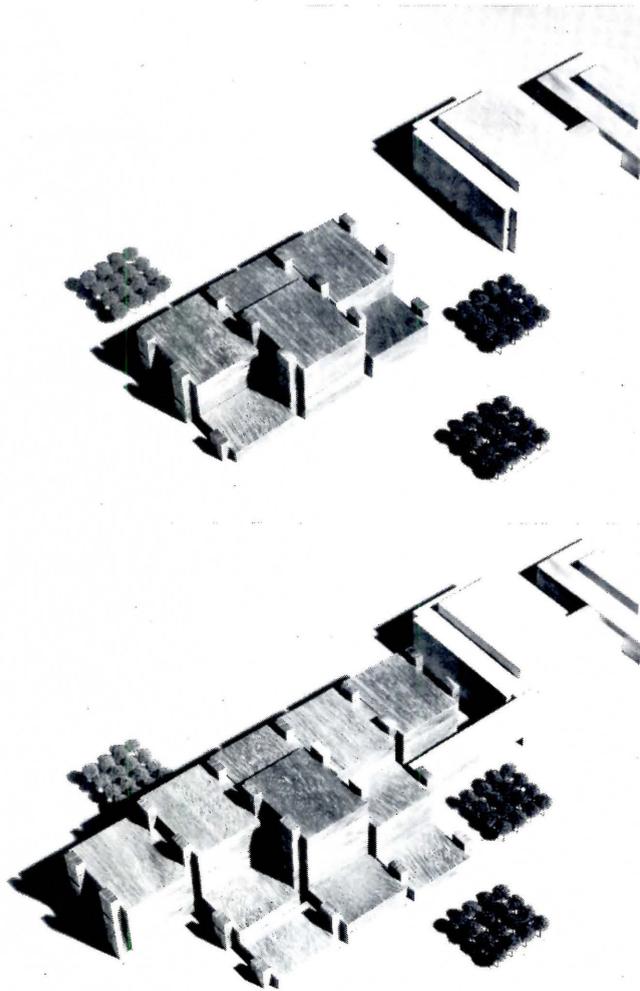
Application of unit theory to hospital design has been a demanding proving ground for the method in that hospitals are an exceptionally complex building type. The method can be applied to other building types with similar effectiveness, although the margin of advantage may be less dramatic.

Development of the hospital super-module is not radically different from conventional practice. For example, the nursing unit acquires a configuration related to the number of beds per station, the mix of single and multiple bedrooms, and the code requirements regarding stairwell distances, smoke barriers, etc. Similarly, the spaces for supporting services develop in modular accretions depending on the program.

The unit theory, then, observes these aggregates as they emerge from the program and translates them into a basic planning and structural module or sub-assembly which responds to requirements of the program while it retains the architect's essen-

Configuration of the super-module that evolves in unit theory design responds to the decisions made at key points in the program/budget/design development process. In most hospitals, for example, the distance from any bed to the nearest exit stairwell or fire escape is a maximum established by code and may determine the outside dimensions of the module. A trade-off between construction cost and

functional flexibility may determine whether a column structure, clear span structure or free space structure (usually in that order of increasing cost) will have its effect on module configuration. The vertical dimension of the module similarly depends on how much interstitial space is allowed as an investment in flexibility. The amount and variety of ancillary space determines distribution of additive units.



tial options in arrangement. When the arrangement of sub-assemblies is performed with architectural attention to problems of traffic and proximity, the building design emerges, and its natural massing grows.

The module itself, since it is repetitive only in the sense of accommodating functional aggregates and fixed elements, offers the classic economy of repetition without constraint on the over-all architectural design. Further, it permits consideration of such cost items as structural span and accelerated project management to be related to the real economics of ownership.

The idea had its genesis at SH&G shortly preceding the programing of a new medical teaching hospital for Michigan State University. It was applied during programing and design of that facility and proved itself capable of flexibility and economy throughout the design development and construction processes. When a substantial increase in programed space was suddenly called for, design revisions were

made over a long weekend. Application of the unit theory actually made the difference between the possible and the impossible.

The unit theory can be applied to any program, but configuration of the emerging unit may be entirely different from one program to another. The decisions regarding dimensions and configuration of the unit are made at key points in the programing process as it deals with, for example, fire control, utilities distribution, etc.

In a recent progress report, John Sheoris and Thomas Klausmeyer have written: "This method is currently developing at a rapid rate. It is also providing important aids to communication among clients, architects and constructors in new approaches to the management of health facility projects. For instance, overlapped scheduling provides important savings in time and money and can be done best when mutual understanding of the design method allows effective management to proceed. We learn from each new effort and our hospital clients also

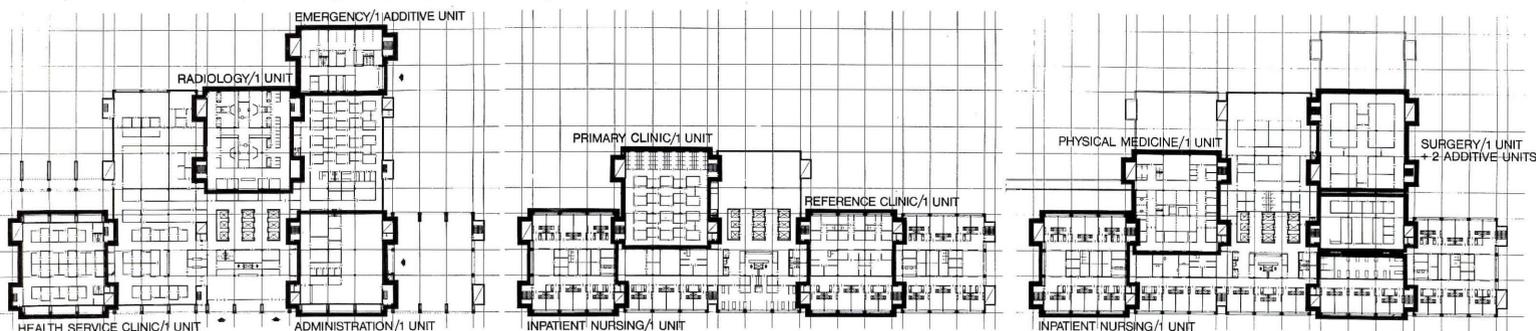
learn how to release some of their traditional constraints on the physical plant. Concerned government health agencies are interested in the program and are cooperating with these efforts. The objective is a vastly improved, perhaps revolutionary form for the modern hospital."

As currently applied, the unit process requires these general steps:

- 1) Establish categories of use for space.
- 2) Define levels of environmental performance.
- 3) Determine physical design criteria that produce those performance levels.
- 4) Estimate probabilities and time frames for future alternative uses of space.
- 5) Weigh the use-performance-change factors against predicted costs.
- 6) Develop a plan unit applicable to the program.
- 7) Specify the most appropriate mix and arrangement of units.



Michigan State University teaching hospital, East Lansing



The teaching hospital, proving ground for UTD

During their continuing search for design methods that respond to the increasing pressures of complexity and cost control while retaining creative architectural integrity, John Sheoris and his associates were (fortunately, it turns out) urged on to supreme effort by the commission for a new teaching hospital for Michigan State University. The program statement was sufficiently general to make a new approach potentially useful or even essential. Stipulations were for expansibility, innovative design and flexibility—but within exact budget and schedule.

Teaching hospitals, differing generically from service-oriented community hospitals even in their patient treatment areas, differ also among themselves to the extent that each presents a unique design problem. They have in common, however, an overlay of people-related complexities and pro-

grammatic uncertainties that are a severe test for any innovation in design approach. The two teaching hospitals shown here may serve to underscore application of unit theory design to that kind of complexity.

Michigan State University teaching hospital (above) was the "pilot project" for development of the method, while the Grace Hospital (page 94) is an application to a new non-profit central unit of the Detroit Medical Center. The teaching role at Grace Hospital is a subordinate one (so far) with limited para-medical and other "teaching unit" spaces allocated in the program. Its proximity to other university centers in Detroit's growing center for medical sciences, however, provides added incentive for future flexibility in its design.

In the architects' approaches to the design for Michigan State University, a number of schemes were considered. In his 1969 paper on the unit theory, Sheoris emphasized that the analysis of vertical schemes was particularly conducive to de-

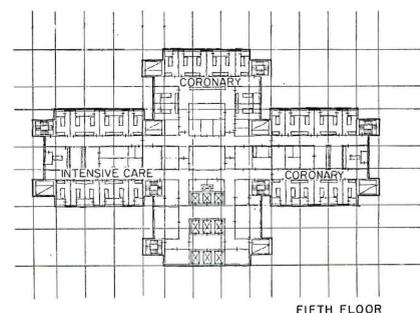
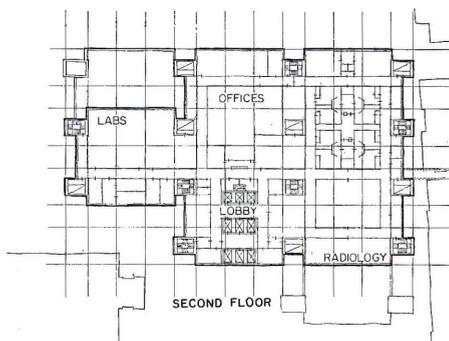
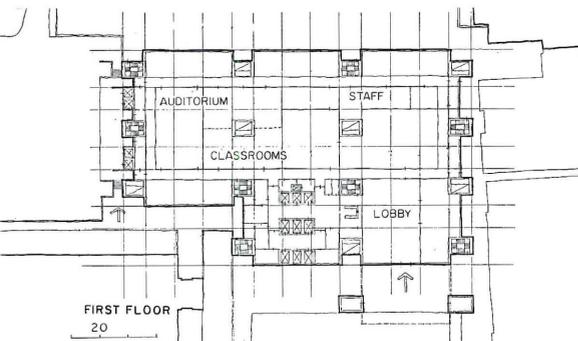
velopment of the theory. Studying the effects of containing all functions in a compact block in which each floor is effectively a self-contained discipline, he said, "A three-dimensional matrix was produced which offered special opportunities related to proximity and relationship of elements in the teaching hospital environment.

"During this period of analysis, while viewing configuration related to cost and program related to function (and adjusting to the client's changes in the program), certain groupings and masses of space developed into separate and distinct units."

These units evolved in the manner already described. At Michigan State, the floor-to-floor height is constrained by a requirement to match the levels of a life sciences building to which the new hospital is planned to be attached. This limited opportunities for accomplishing mechanical flexibility through use of interstitial spaces and supported the decision to use the columned structural module. Over-all massing



Grace Hospital, Detroit Medical Center



configuration at Michigan State was further influenced in a horizontal direction by its campus location and its master plan for phased future expansion, as in the block-study photo on page 92.

The program requirements at Michigan State were enabled by unit theory to develop as the new hospital was being designed. The design information input could be tailored to the level required by planning progress rather than to a pre-determined over-all program. This process permitted a feedback interplay between design and program which was facilitated by the supermodule concept. First, the module itself could be regarded as a workable, integral, functional aggregation, once the gross parameters of the nursing floors were established. Second, the method itself augmented client-architect communications so that the program could be developed and refined in terms of design considerations. Third, the time required for design response to program was minimum.

At Grace Hospital, a detailed net space program had been previously worked out by the consultant office of Anthony J. J. Rourke, Inc. This provided a sound basis upon which the architects could begin a quite rapid series of exploratory schemes applying the already-tested principles of unit theory design. These schemes were readily related to both current and projected cost estimates based on the three construction options previously mentioned (columned, clear-span and free space) and provided a realistic evaluation of interstitial space as a mode of providing mechanical flexibility.

The Grace Hospital design gained other advantages from the unit theory method. First, the restricted site impelled a more vertical (hence more repetitive) assembly of modules to accommodate the 398-bed capacity. Second, plan-revision time was kept to a minimum when, during the design, the number of beds was reduced from 420 to accommodate a change in mix from 33

per cent to 85 per cent of beds in single rooms. Third, the reduced number of fixed elements in stacked supermodules in the vertical scheme readily accommodates the layering and delivery systems that promote efficiency in modern facilities.

The construction mode adopted at Grace Hospital was a free-space unit which, because of its unencumbered structure, promoted the application of cost-reducing project management techniques. The free-space module also allows both vertical and horizontal distribution systems to be designed without structural constraint so that the arrangement of vertical shafts in the module can be determined rationally and economically with respect to the sizing of horizontal runs of mechanical systems. The combination of unit theory design, accelerated development, phasing and concurrent design and construction was estimated to have reduced optimum completion time by 17 months—a considerable factor in today's escalating market.

Planning the hospital for a changing system of health service

By Michael L. Bobrow, Medical Planning Associates, Malibu, California

National health insurance will call for new kinds of medical plant and personnel, as already foreshadowed in effects of Medicare, Medicaid and private insurance. Architects can start now to look ahead rationally.

■ Hospital planners and responsible architects must urge hospital clients to review current space needs in the context of long-term future expansion. Frequently, however, estimates of need are straight-line projections, and master plans tend to be based on past growth patterns. Such plans fail to take into account the effects of national health insurance and other social changes which are rapidly being legislated into existence.

What factors can we reasonably predict as major influences on health care in the future? What emerging trends should our designs accommodate? Should our clients be concentrating their resources to provide more hospital beds, or more outpatient facilities, or more training schools, or all three? Who has the crystal ball? Nobody, probably. It has become a cliché to say that health care in the United States is enormously complex, fragmented, and confusing. Nevertheless, things are happening which are certain to exert a major effect on the system and its facilities.

It is generally agreed that the next few years will see virtually every American covered by some form of health insurance, sponsored by the Federal Government and paid for by greatly-increased Social Security contributions. A number of bills aimed at providing this type of coverage have already been introduced in Congress, and there is little question that some legislation will be enacted before long. Every citizen will ultimately be a beneficiary of the newly-articulated concept of health care as a basic right. This fact has enormous implications from the standpoints of cost, quality of care, and delivery methods. For the hospital architect it also has enormous implications from the standpoint of design.

The Medicare-Medicaid surge, a biased data base

The U.S. government has already taken the first steps toward providing some level of basic health care. Logically, these first steps were taken where the needs were greatest—among the aging, through Medicare, and the poor, through Medicaid.

Critics of the two programs, who see them as financially disastrous, flatly predict that the Medicare-Medicaid experiment represents a model for failure in terms of universal prepaid health coverage. Almost everybody is familiar with the problems these two programs have encountered, but it should be realized that some of these problems lie with the selected populations the programs were designed to serve.

The fact that the old and the poor suffer from the highest incidence of health problems made those groups the logical candidates for the first nation-wide relief. But it also had the effect of orienting Medicare and Medicaid to a backlog of acute and chronic illness, requiring immediate treatment—the most expensive kind.

It is frequently claimed that at any acceptable national standard, preventive care is cheaper than treatment of illness. But preventive medicine has little relevance when applied strictly to a population over the age of 65, or one already suffering from widespread malnutrition and neglect.

Physical facilities will be designed for prevention, not cure

When the base of coverage is extended over a total population—young and prosperous as well as old and/or poor—the per capita cost can theoretically be lower. That is the theory. For the theory to be realized in fact, the delivery system and its physical facilities must be radically altered to concentrate the effort on prevention, if possible, or at least on early diagnosis and rapid care.

Medicare proponents themselves have come to recognize the validity of such an approach. Recently proposed Medicare amendments would encourage persons over 65 to enroll in health maintenance organizations such as the California-based Kaiser plan, which would be responsible for providing Medicare benefits.

"Such an organization," a *Los Angeles Times* story said, "would have an incentive to hold down costs since it would get the same payment for each enrollee, regardless of the costs of medical services provided." The implication is that Kaiser would apply the same principles of patient care to Medicare recipients as to its other insureds—i.e., emphasis on prevention, early diagnosis and timely treatment of illness, with minimal in-hospital care.

Private insurance plans tend to foster inpatient services

Everyone is familiar with the accusations leveled at most of the existing private health insurance plans, to the effect that they tend to foster excessive utilization of inpatient facilities by biasing their benefits toward inpatient services. This is probably less true today than it was a few years ago, but a bias still exists in many plans, for obvious reasons. The private plans were developed for the purpose of shielding their insured against the financial disaster of a catastrophic illness. Since the plans could not cover all medical costs without charging relatively high premiums, reimbursement formulas were geared to in-hospital costs.

The inpatient bias in turn led sympathetic physicians to admit patients to the hospital for procedures which could have been performed in the outpatient department or in the doctor's office, in order to have the protection of insurance.

Since the time when most of the private insurance plans were started, however, health care costs have risen to the point where the patient may feel that any illness, no matter how minor, is financially burdensome, if not catastrophic. A middle-income patient who has just been handed a four-figure hospital bill for a routine surgical procedure may justifiably feel that without his health insurance, he—along with most of the population—could justly be labeled "medically indigent."

Universal health insurance could initially swamp the system

As contrasted to many existing private insurance plans, universal health insurance probably would defray the cost of minor as well as major illness, routine care, and regular physical examinations, with the objective of detecting and treating illness at an early stage, preferably outside the hospital.

What will be the immediate effect of this altered public policy, assuming that any one of the schemes becomes law?

One of the lessons we should have learned from Medicare was never to underestimate the initial impact of such legislation. The number of over-65 citizens who lined up for long-deferred medical and surgical procedures, though not overburdening the entire system, caused great backlogs at certain specialized facilities. The people, representing all ages and income-groups, who would line up for Federally subsidized health care could conceivably crush the system by the sheer weight of their numbers, unless the system is prepared for the onslaught.

Since the initial high demand can be expected to level off over a period of years, should temporary facilities be planned to meet these needs? A number of manufacturers of prefab structures have recently entered the clinic building field, and market a wide range of simple prefab medical structures, some designed to be relocatable. Research projects have been aimed at developing a mobile unit which would provide a reasonably complete diagnosis and treatment facility.

Screening and outpatient facilities will increase and change

It might be assumed that a program of universal insurance will involve some mass health-screening procedures. Mass-testing would presumably utilize all types of existing health care facilities, but would still impose a great burden unless other kinds

of community facilities could also be utilized. Schools, churches and community recreation centers have traditionally served similar purposes—health screening for groups of preschoolers, mass inoculation programs, etc.—and could absorb some of the impact. Mobile units could help.

Once the initial problems have been identified and the rush is over, what sort of permanent facilities will be needed?

Obviously outpatient services (including physicians' offices) will take on much more importance, relative to inpatient facilities. More diagnosis and treatment will be performed on an outpatient basis, including minor surgical procedures which have heretofore involved hospital admission. Hospitals are already recognizing this trend and are planning and constructing special "in-and-out" surgery departments, where patients may be prepped, anesthetized, operated on, recover in a special observation area, and go home within an eight-to-twelve-hour-day—all without being admitted to an inpatient unit. A recent Department of Defense study indicated at least 20 per cent of current surgical patients could be handled this way.

Periodic physical examinations, now a luxury that low-income families cannot afford, will not only be available but would probably be encouraged under universal health insurance. This will create a workload beyond the capacity of present diagnostic facilities, and we are likely to see the construction of many more facilities for multiphasic screening—preliminary health evaluations performed on large numbers of people, with the help of computerized diagnostic and retrieval techniques.

The Kaiser plan mentioned earlier developed the multiphasic screening technique for a broad group, and its physicians and administrators have acquired considerable expertise in this area. The objective of multiphasic screening is not only to amass diagnostic data on large numbers of people by applying assembly-line techniques to routine tests, but is also to maintain a dynamic record for each patient over a number of annual or semiannual examinations. This provides an individual health profile rarely available under today's system, due to the mobility of the population and the tendency to shop around for medical attention.

Group medical practice will be the norm

There is general agreement that some form of hospital-based group medical practice will be a common pattern of medical care in the future. Even the segments of the medical profession which have publicly opposed the group practice concept are beginning to concede that it will one day be the norm. At least one of the major bills for national health insurance is proposing grants to help establish hospital-oriented groups.

Whether or not a hospital's medical staff is formally organized for group prac-

tice, it is likely that members will maintain their offices in a building attached or close to, and possibly owned and operated by, the hospital. This will help to eliminate the doctors' non-productive travel time between hospital and office. It will also allow more efficient sharing of sophisticated facilities and equipment, and will insure that the doctor can reach his hospitalized patient's bedside quickly in an emergency. Visually and functionally, then, the hospital becomes part of a broader, more effective health care center.

For all of these reasons, we feel that the individual hospital's master plan should certainly include provision for a professional office building either contiguous to, or integrated within, the hospital itself.

For architects, new plans, but not just more and more

For ten or fifteen years, hospitals have been moving toward progressive patient care—i.e., the hospital is arranged and staffed to provide the level of care required by the individual patient's condition, but not more than is actually required as his condition changes. This has already had a major effect on facility design. Hospital architects are asked to plan every type of inpatient care unit from minimum-care diagnostic and treatment units for the ambulatory patient, to sophisticated intensive care units that provide constant professional nursing care—often at ratios approaching one-to-one—along with electronic monitoring of the patient's physiological functions.

From the intensive care unit, a patient may be moved into a regular (acute-care) nursing unit and still later, if necessary, into a rehabilitation unit where the emphasis is on self-care coupled with whatever therapy is required to complete his recovery.

Health planners have already begun to favor removing the less-acute patient from the hospital altogether, and housing him in an adjacent hotel-type accommodation where he can be maintained at a much lower cost while continuing to benefit from close medical supervision and use of hospital facilities. These measures will have to be applied more stringently, if the nation is going to realize full value from its health care facilities.

What effect will this segregation by severity of illness have on the acute hospital? Obviously, if we remove the less acute cases, only the sickest patients will remain in the hospital. They will require the most intensive professional care, the most sophisticated facilities and equipment available. Thus there is some justification for the statement that tomorrow's acute general hospital may be a collection of intensive care units and chronic care units, together with required ancillary facilities. In any event, the units will be designed more specifically for each function. Universal medical coverage would force solutions for a number of tough medico-moral problems. Our national conscience has long been bothered by the fact that although we have

the medical and technological means to treat certain chronic, life-threatening conditions, the treatment resources are so scarce as to be available to only a handful of patients. The question of who gets the transplant surgery, or the renal dialysis—in more ultimate terms, who has the right to live?—has provided the dramatic conflict for any number of television serial episodes. With the government picking up the bill, will such treatment become available to any citizen who needs it? Can we provide the skills and the equipment without bankrupting the system?

Architects cannot answer such questions—but they will be planning the facilities which will house the answers, and must be prepared to pose these problems to the client.

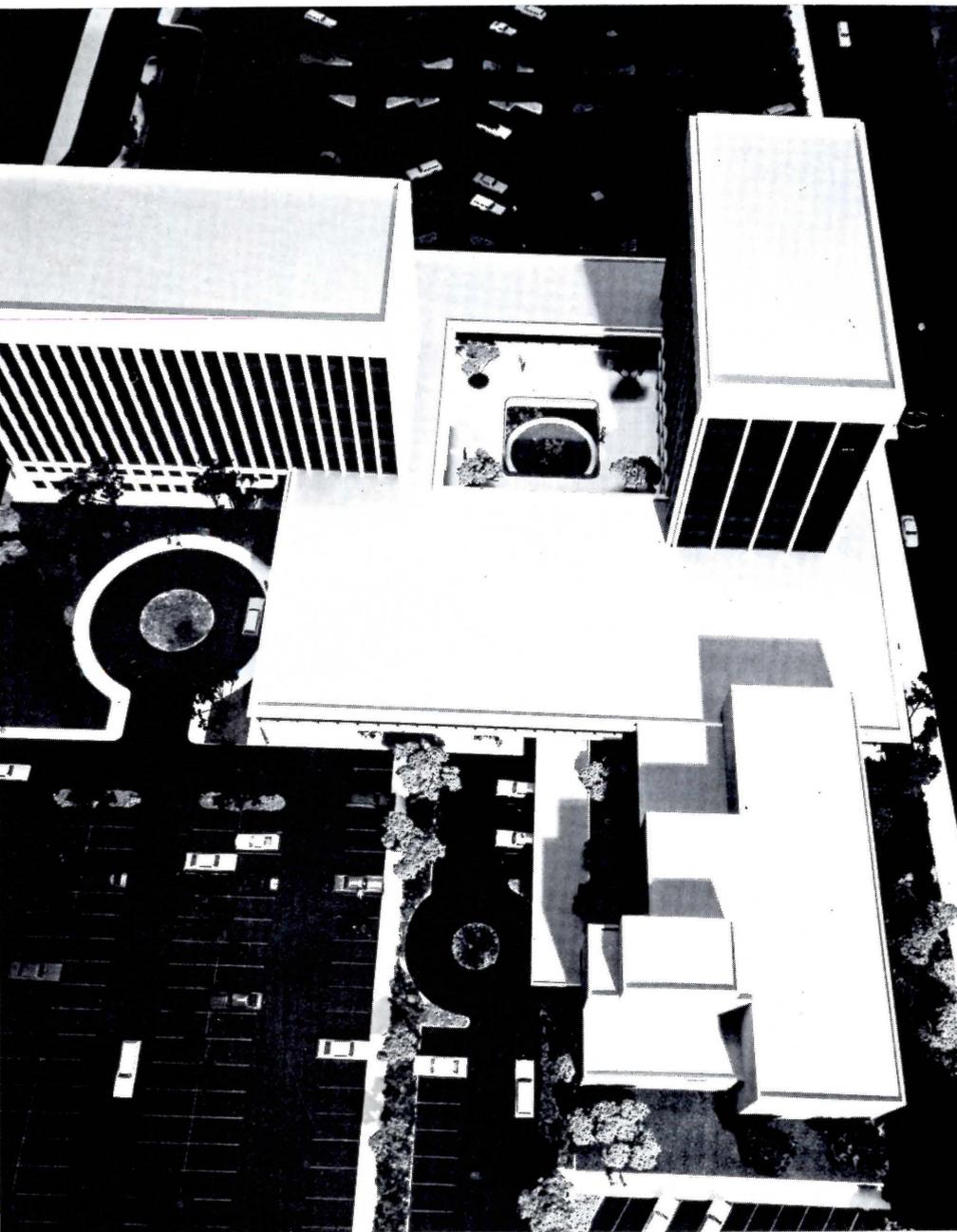
Training centers needed for new kinds of para-medics

It appears certain that many more facilities for training physicians, nurses, technicians and other paramedical personnel will be built in the next few years—with or without Federal health insurance. Recognizing the high cost of producing enough physicians to meet even today's demands, a number of agencies have instituted training for a new breed of allied health professional. The "Medex" program in the Pacific Northwest is one example. Most of the Medex trainees and graduates are former Army medics or Navy corpsmen. Neither physicians nor nurses, they are trained to perform routine diagnosis and treatments which require a high degree of skill, but less medical judgment than that normally required of a physician.

The California state legislature recently passed the Wedworth-Townsend Act, which is the first measure enacted that will permit individuals who are neither doctors nor nurses to do certain procedures in critical situations. Under the provisions of the act, such trained individuals may perform cardiac resuscitation, give intravenous treatments and administer drugs. The first group to be trained were twelve members of the Los Angeles Fire Department.

The training of professional and non-professional medical and nursing personnel will be a major effort for the university medical centers. Community and junior colleges may take over responsibility for much of the training of licensed vocational nurses, medical and dental technicians, laboratory and radiological technicians, and the like. However the needs are met, more facilities are going to be required.

Although we may still have more questions than answers about the shape that will be forced on tomorrow's health facilities, there are certain models in existence. One of the best-known private prepayment plans, administered by the Kaiser Foundation, incorporates the principles of group medical practice, integration of outpatient and inpatient facilities, and emphasis on preventive care. The California-based Ross-Loos Medical Group demon-



Hollywood Presbyterian Hospital, Los Angeles. Service podium links nursing tower, left, with office tower. Architects: Ladd and Kelsey; consultants: Medical Planning Associates

share certain services. An increase in floor area per bed—a frequently-used figure—from the current average of 700 s.f. to well over 1000 s.f. can be anticipated as these support facilities grow.

A "unit-record" system, with a single cumulative record for each patient, whether inpatient or outpatient, will dictate new design concepts for the storage and retrieval of medical records.

It would be possible, but not particularly useful, to go on listing those changes which we can foresee taking place in each hospital department. The changes which cannot now be predicted will undoubtedly overshadow those which can. Therefore, the facilities under design today could be tragically outdated at the point of occupancy—unless they are designed to accommodate a maximum of change.

The over-all scheme must allow for both predictable and unpredictable growth in all departments, and for the addition of new departments as required, with minimum disruption to either services or traffic as the work proceeds.

To us, this means:

Larger sites to accommodate needed facilities such as medical office buildings, motels, extended-care facilities, rehabilitation centers, and mental health centers. Parking requirements will increase drastically as the need for a minimum of 5 cars for each doctor in practice on the site is superimposed on the already increasing needs for the hospital itself.

Permanent circulation spines, both horizontal and vertical, to define future growth patterns and maintain a simplified traffic pattern.

A flexible and enlargeable transportation system for people and materials.

Long-span structures for ancillary facilities, to allow for internal alteration and lateral growth—each department growing at its own rate.

"Disposable" patient-care units in separate structures, for easy replacement.

Capability for physiological monitoring in most or all patient-care areas.

Less built-in equipment for easier alterations—utilities coming from above rather than within the wall.

In conclusion, national health insurance will produce significant changes in health facility design. National health insurance can be expected to lead to a new system of health services in America rather than simply financing the old one. As one leading proponent of national health insurance stated, "medical care follows the buck," and when financial barriers to comprehensive health care are removed, there will be a shift in structure to health maintenance as opposed to crisis intervention which is the current pattern of hospital care. This shift will provide a severe test of the hospital's ability to adapt its program and facilities to the new era and challenge the architect's creativity in designing facilities that will accommodate to these changes.

strates prepaid care in a group practice set-up, while Seattle's Virginia Mason Hospital and Clinic provides all care in one facility without prepayment.

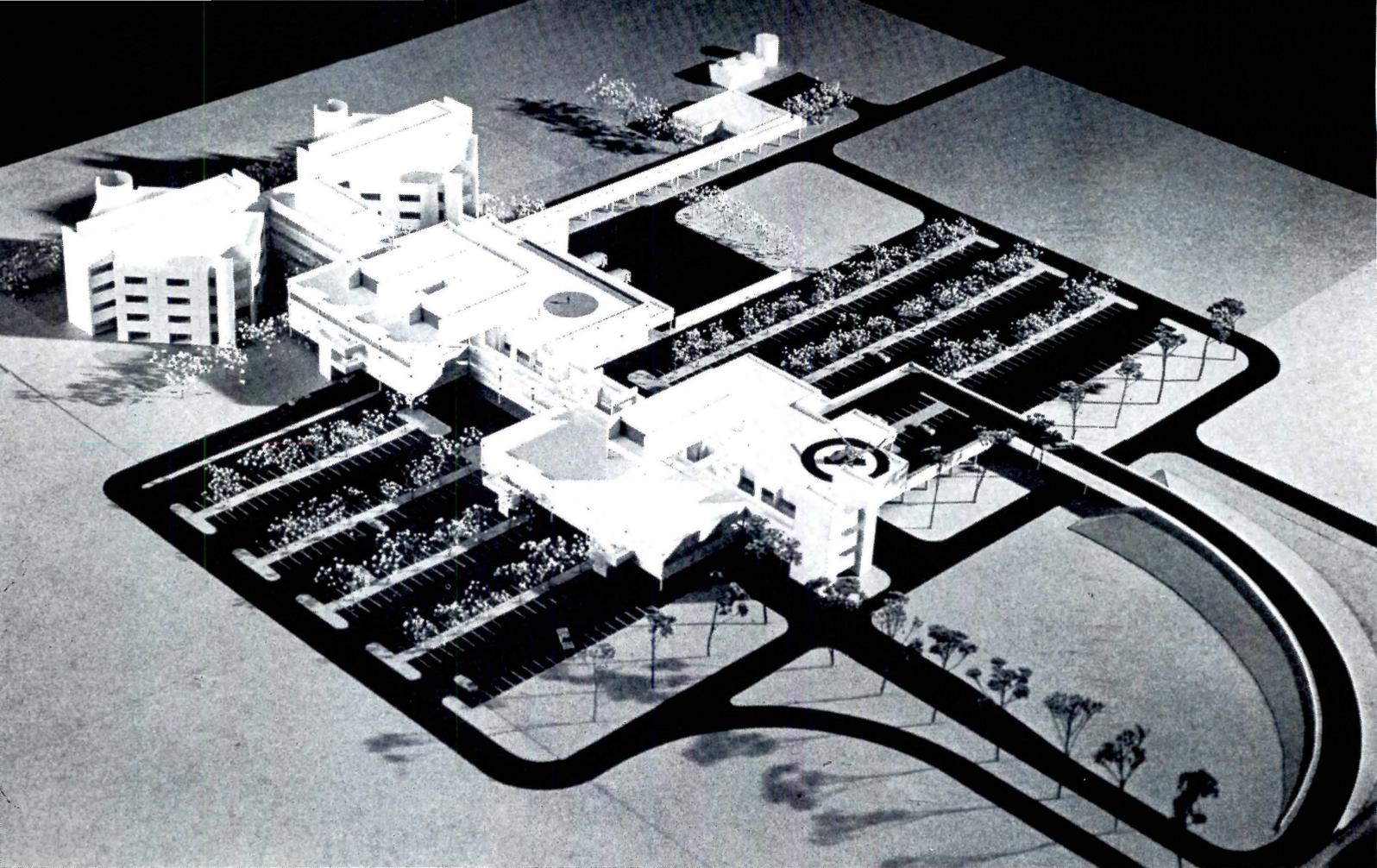
Military hospitals generally incorporate extensive outpatient clinics and have a strong orientation toward preventive services and routine health maintenance. (Even so, the previously mentioned study performed under contract to the Department of Defense concluded that some 50 per cent of the inpatients in a military hospital at any given time could probably be treated as effectively in facilities offering less elaborate care.)

Teaching hospitals are undergoing a reorientation toward providing integrated outpatient and inpatient care. All of these types have certain characteristics which might serve as prototypes for segments of tomorrow's health-care system, although again, the shape of the total system will depend upon a determination of the level of care which is considered necessary.

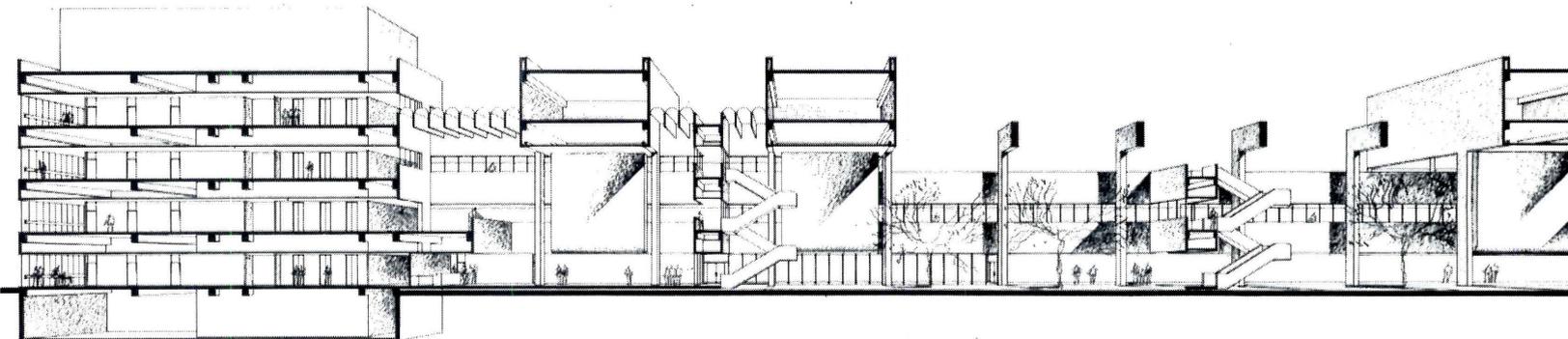
Thus we might reasonably make a number of assumptions about the impact of universal health insurance on facilities planning. For instance, we can probably assume the following trends:

Physicians' offices will be located within, or at least contiguous to, the acute hospital. The individual doctors' suites will be reduced in size as more and more physicians take advantage of the ready availability of the hospital's diagnostic and treatment facilities and equipment. Conceivably, there will be no outpatient clinics as the payment for all patients will come from the same source; perhaps all patients will be treated in doctors' offices for outpatient conditions.

Hospital diagnostic and treatment areas will expand accordingly to meet the needs of both inpatients and the greatly extended needs of outpatients. However, we will see far less duplication of facilities and equipment as hospitals, either voluntarily or under regulations, enter into agreements to



Desert Samaritan Hospital: planning on a regional scale



An unusual combination of rapid growth in the Phoenix-Tempe-Mesa corridor and the merger of several hospitals in the region provided opportunity for a new hospital designed for regional needs by Caudill Rowlett Scott with Drover, Welch & Lindlan.

■ The Samaritan Health Service Corporation developed from the merger of several hospitals, including the 724-bed Good Samaritan Hospital of Phoenix and the 140-bed Southside Hospital in Mesa. Studies of savings and improved care for patients, made possible by regionally balanced services, led to the creation of the Samaritan Health Service System. This is the first new hospital planned and designed for this kind of corporate system for operating voluntary non-profit hospitals and other health facilities in Arizona.

A 90-acre site of flat desert is the setting for the Desert Samaritan Hospital. It is bounded on the north by a major street; south, by a freeway; east, by Mesa Com-

munity College and a boulevard, and on the north by a man-made irrigation canal. The hospital is located between Mesa and Tempe in a rapidly developing suburban area.

The Desert Samaritan Hospital was designed as a full service hospital extending for the community increased resources and professional services available traditionally at Southside Hospital. The program calls for greater service capability in every department as well as the creation of new areas of service. Major emphasis is also placed on outpatient care, and preventive and health maintenance programs. First phase hospital construction (275 beds) and related services will be completed in 1972.

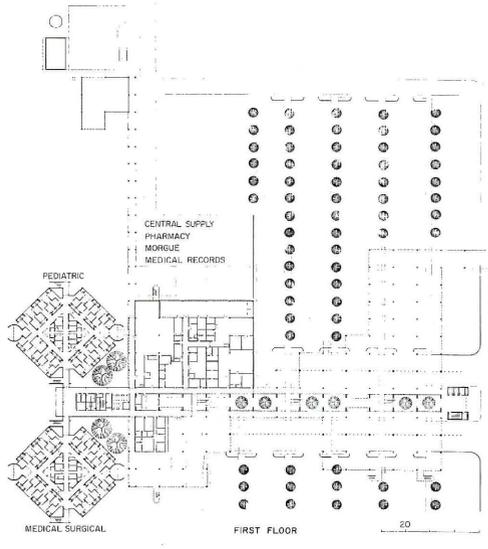
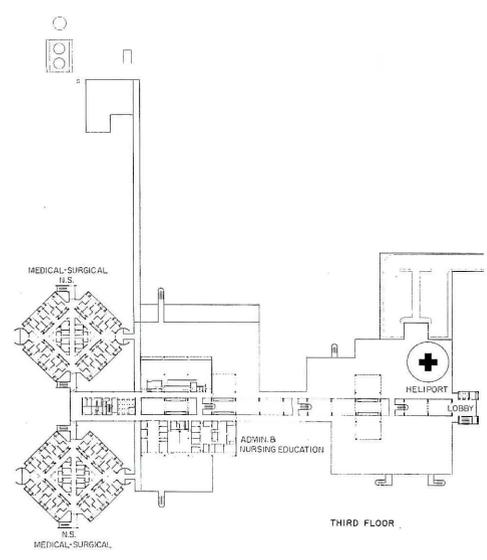
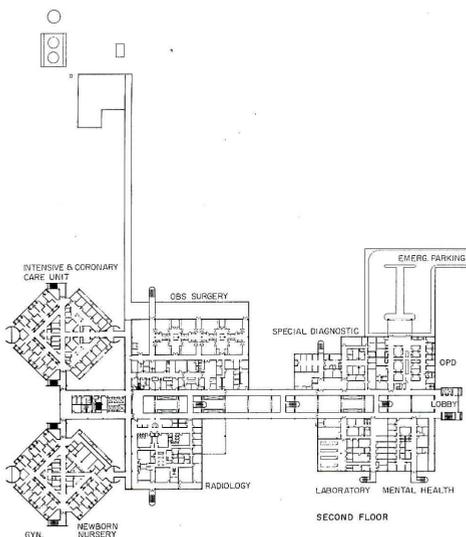
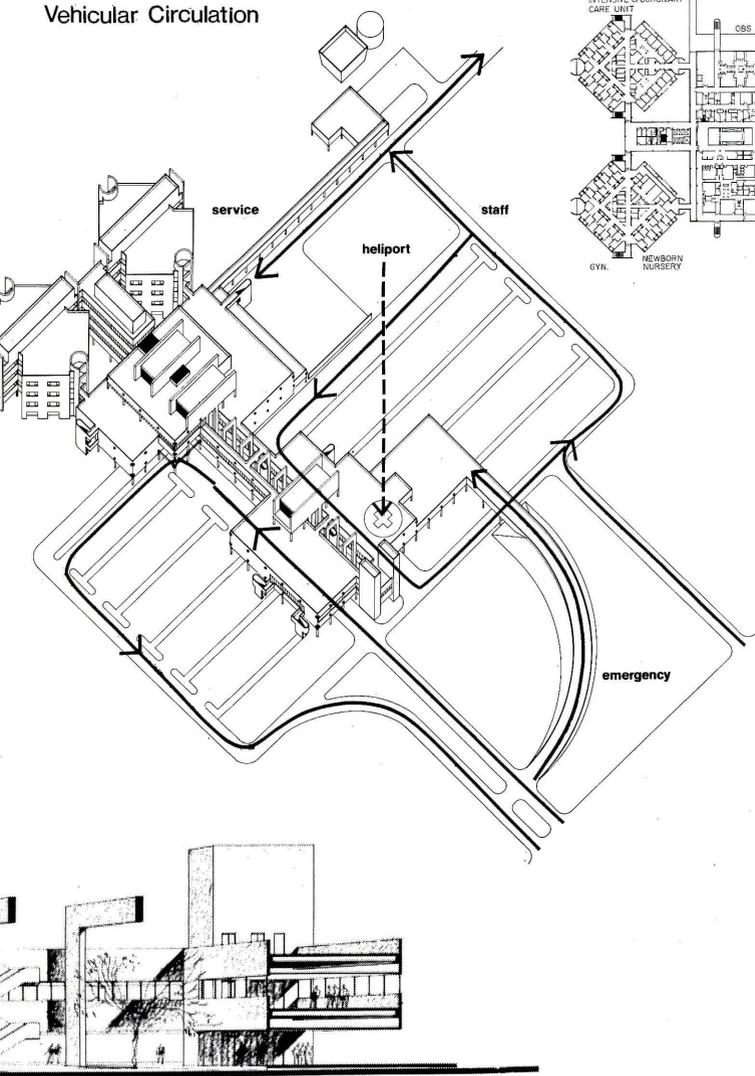
Goals of the owning corporation are: 1) to provide for an unprecedented growth rate (by adding different kinds of spaces without disturbing services); 2) reduced operational costs and increased quality of care; 3) a balanced program to include education, community health programs and

research; 4) advantages of corporate central management, purchasing, laundry, data processing, and food preparation serving the whole system. A rapid construction schedule using fast-track project management techniques, with overlapping instead of consecutive design and construction phases (and with the general contractor as one of the team) will advance both cost and service objectives.

The desert climate and community attitudes have demanded a regional architectural response. The large, flat site permits unlimited horizontal development. A sense of orientation for patients, visitors and staff has been created by the development of pedestrian concourses. Continuous growth without disturbing patient or department activities has given a form for growth and change. There is a duality of image for the community: a) precise and professional capability and b) personalized southwestern informality.

There is a strong interrelationship of

Vehicular Circulation



functional departments in a flexible plan with emphasis on expansibility and convertibility. Functional mobility is a major criterion for the hospital; therefore, a clear circulation system for patients, visitors, staff and goods is required.

The hospital staff was intensely involved with the architect-consultant team during planning and design. This team established functional affinities for the hospital with a multi-level gaming board of clear plastic and color-coded squares of paper that were cut to scale to represent departments and arranged on the board until both vertical and horizontal relationships were agreed upon.

A reinforced concrete structural frame with precast concrete joists meets seismic criteria. Exterior skin walls are gun-applied stucco, reflecting a regional tradition of materials as well as providing a thin, economical, disposable wall for future growth. Floors are carpeted, except where hard surfaces are required by area activities. The

ceiling is a lighting system designed on a 4-foot, 6-inch module for maximum flexibility. The module was chosen through computer analysis of all programmed spaces (which range from 35 to 360 square feet), applicable codes and parking requirements, as giving the closest net fit for the medical program.

The central hospital buildings are air conditioned by a high-velocity, terminal-reheat system distributed through interstitial space that permits complete flexibility. Vertical chases spaced along the length of the building carry power, heating and cooling fluids from the air-handling equipment and are sized to provide for future growth. In the nursing buildings, two variable-volume air conditioning systems are provided for each floor. A central boiler plant provides power, steam and chilled water to sub-stations throughout the hospital with provision for plant expansion and additional sub-stations to meet future growth needs as they occur.

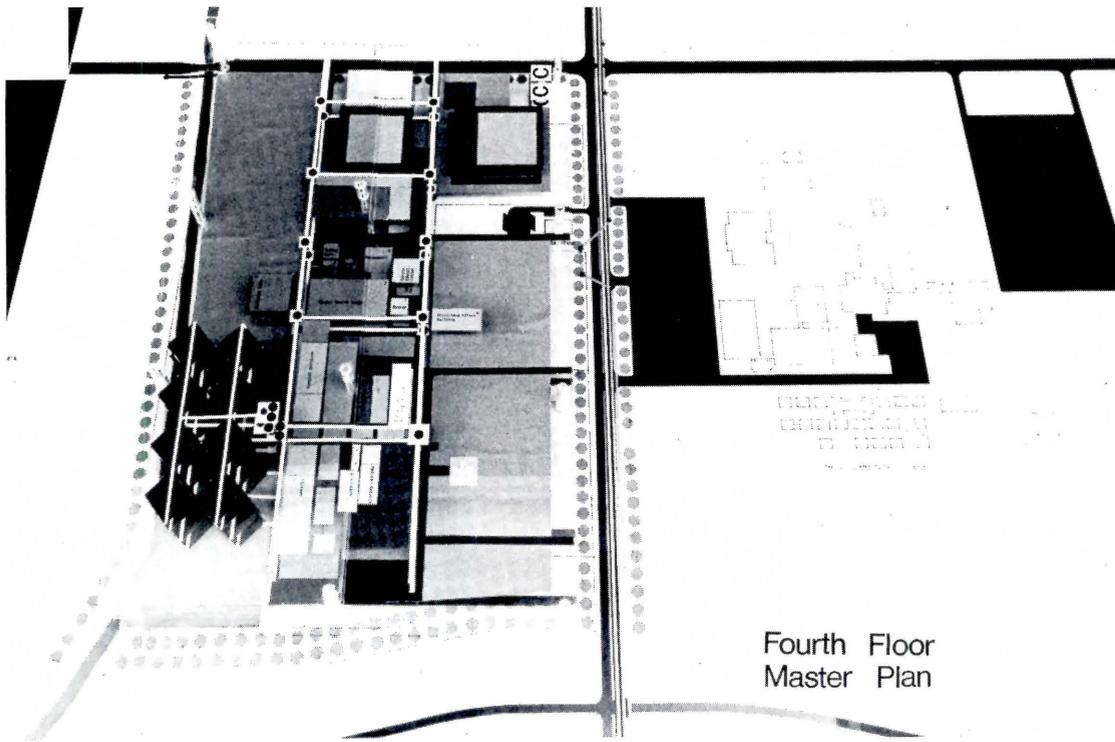
Design Process

The architects sought maximum involvement of the hospital team at each step of the design process. The team was made up of representatives of hospital management, administration, medical staff, departmental heads, operating personnel, representatives from local, state and Federal agencies, community interest groups and others. During functional programming by Hamilton Associates, the architects participated in group discussions with various segments of the hospital team. Local contractors and building materials and systems suppliers were interviewed to guide evaluation of construction options. Questionnaires were distributed to all hospital-related personnel. The response became input for design analysis cards and relationship diagrams (much like those used in industrial engineering) showing adjacency priorities and commerce relationships.

Graphic representations of space requirements were drawn to scale on sheets

SUGGESTED PROJECT RESPONSIBILITY

	Selection of Architect	Programming & Master Zoning Phase	Schematic Design Phase	Design Development Phase	Construction Documents Phase	Bidding Phase	Construction Phase
government agencies							
community groups							
Board	*	*	*	*	*	*	*
building committee	*	*	*	*	*	*	*
administrator	●	●	●	●	●	●	●
hospital consultant	●	●	●	●	●	●	●
advisory committees	●	●	●	●	●	●	●
staff		●	●	●	●	●	●
financial consultant	*						
architectural team		●	●	●	●	●	●
consultants		●	●	●	●	●	●



Fourth Floor Master Plan

of brown wrapping paper which were mounted on the conference room walls during group discussions so that space programming could be seen as a whole.

The clear plastic gaming technique previously mentioned (illustrated above) stimulated interaction of the groups by visual representation of the emerging hospital environment. Each person acted out his own future real-life goal. The result was clarification and understanding of the planning problems. Gaming sessions were held to develop both the master plan and department zoning in the hospital.

Modular planning was adopted as a means of assuring long-term building flexibility. By relating plan elements to a superimposed dimensional grid, department configurations could be altered and moved about freely. Although the modular discipline sometimes exacts a penalty of excess space on the order of about 15 per cent, this was acceptable in the light of increased planning and construction efficiency. Espe-

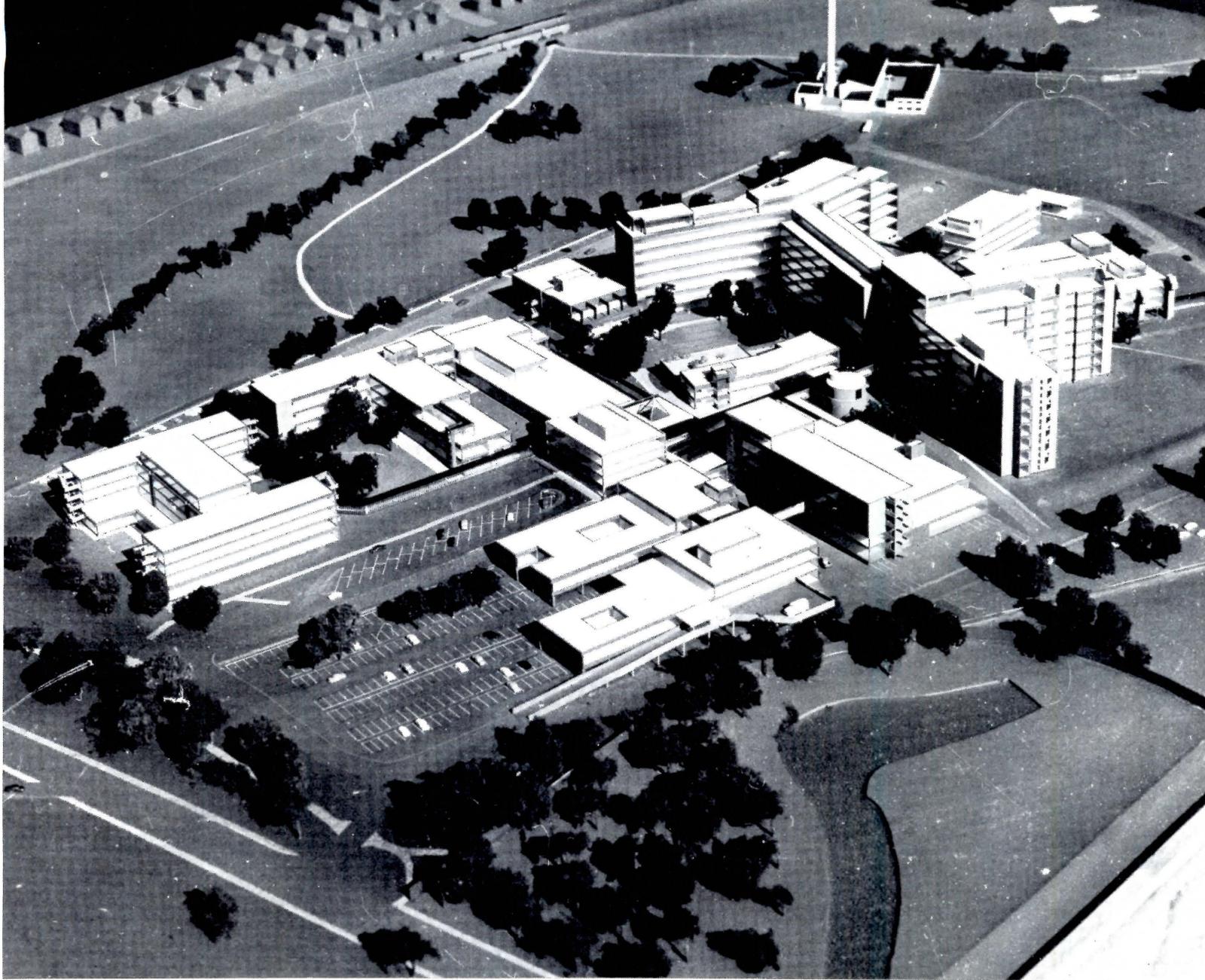
cially so since the probability is high that rapid growth will more than fill the extra initial space.

Another planning approach that insured longer life for the physical facility was multi-strategy planning. This is the concept of evaluating each design idea for its ability to serve uses other than current need. For example, is it possible for obstetrical delivery rooms to convert to surgical operating rooms? Thus, the concept of open-endedness was applied internally in organizational terms as well as externally in physical terms.

At Desert Samaritan, the planning process involved evaluation of three alternative schemes, each of which satisfied the functional priority requirements of the master plan. The basic difference among the schemes was in the consideration of parking arrangements, since these are critical in the growth process of the complex. The scheme selected provides covered parking under the building and surface parking adjacent to entrances.

In his paper on guidelines for health facility design and construction, delivered at the 1970 A.H.A. Convention, CRS partner James Falick underscored the multiplicity of design input sources and checkpoints in the hospital design process. The chart at the top of this page is his visual documentation of the process. The point he makes is that only the skilled architect is prepared by training and temperament to manage the multi-disciplined team and deliver the hospital within the demanding time and cost limitations of today's practice. Further, says Falick, it is important that the architect be allowed to exercise that management role rather than have it constrained or obscured by overriding decisions at the checkpoints. The very diversity of input requires the coordinating action of architectural process.

DESERT SAMARITAN HOSPITAL, Mesa, Arizona. Owner: Samaritan Health Service Corp. Architects and engineers: Caudill Rowlett Scott; associate architects: Drover, Welch & Lindlan; hospital consultants: James A. Hamilton Associates, Inc.



Northwick Park: where only growth and change are constant

Since any pre-determined program of space allocations for a hospital can be only a starting point in the long life of a hospital, "the more carefully the building is tailored to its program, the more certain it is to need alteration and additions very quickly. . ."

*John Weeks, partner
Llewelyn-Davies Weeks Forestier-
Walker & Bor
London and New York*

■ Architecture for growth and change at Northwick Park, London's giant new general hospital and clinical research center, is ample demonstration of what John Weeks, partner in charge of the project, calls "indeterminate architecture"; for which he has been articulate protagonist for a decade. Those U.S. readers who may tend to sense a pejorative "vague" or "ill-defined" in the term might think of indeterminacy as "untrammelled by those determinations of program that can have little factual basis over the life of the project."

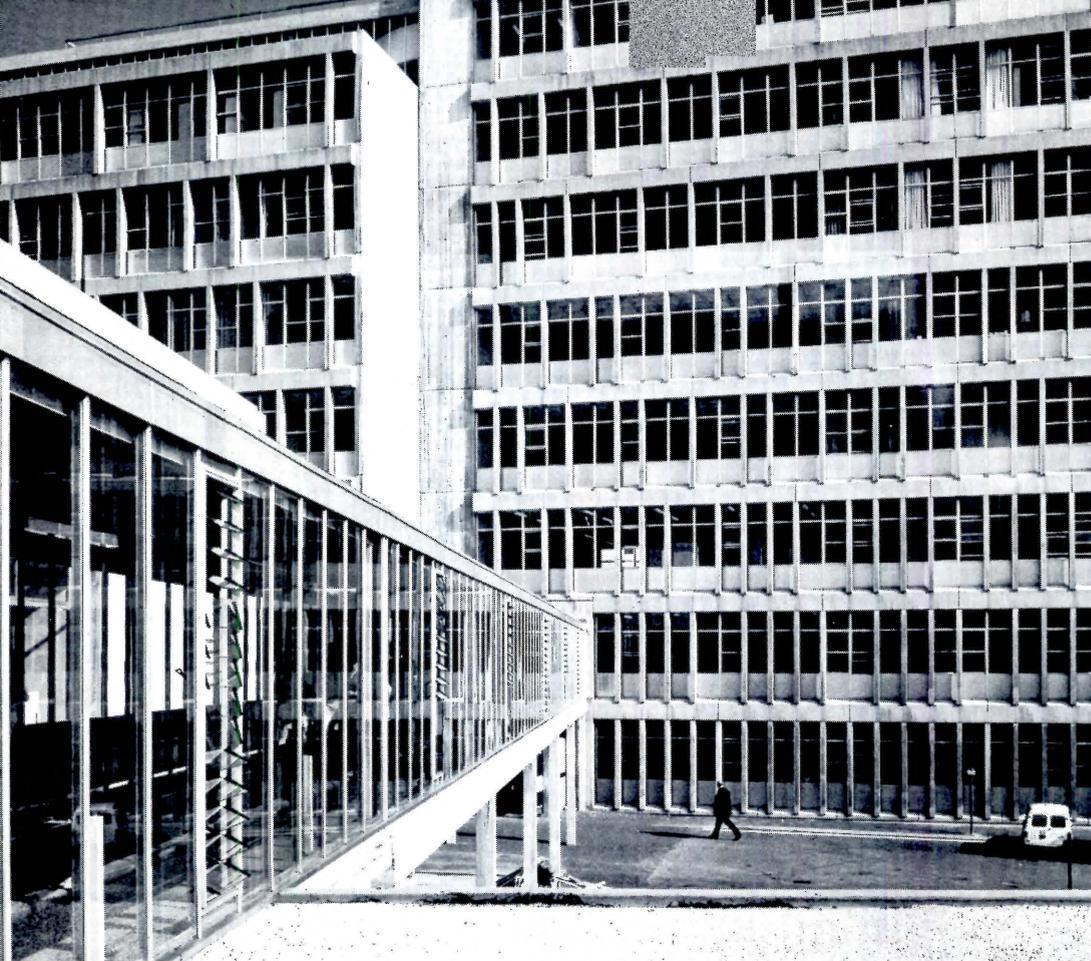
The conditions that impel hospital design toward flexibility and expansibility are urgent everywhere, and inventions for accomplishing those aims continue to multiply. At Northwick Park, the practice of indeterminate architecture brings to inventiveness a discipline of dynamic relationship between plan and circulation and between concurrent program and design development that is not necessarily implicit in flexible expansibility per se.

The program at Northwick Park was drawn up in such a way that three-phased development toward an ultimate 800-beds and associated research facilities could proceed in a properly indeterminate manner—so long as the first phase be completed "as soon as possible" and be a self-sufficient complex. Development is now at about mid-point and the first buildings are ready for occupancy. Ultimate construction cost will be on the order of \$37 million for about 1.5 million square feet.

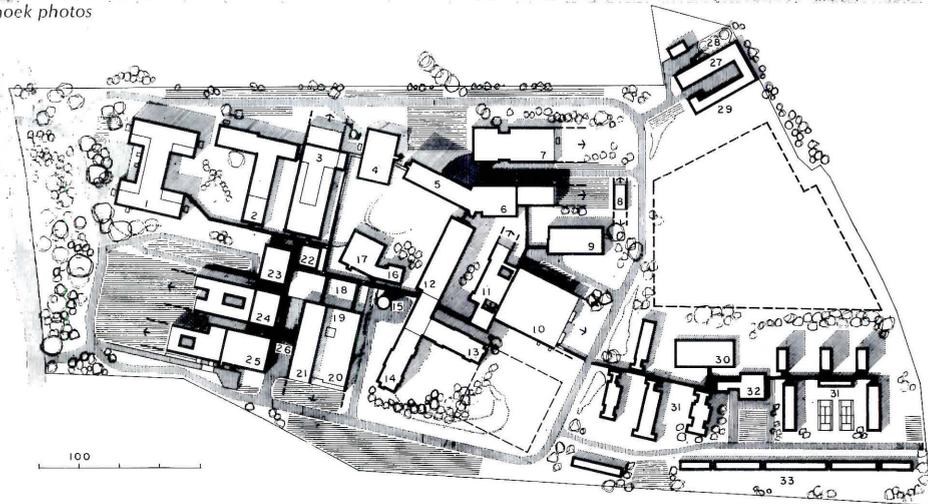
About the only firmly developed com-

ponent of the early program was the communications-circulation spine which was laid out on the 46-acre site with some reference to contours and future building orientation. Mainly, however, it was designed to play a permanent role in the development process. From it, in fact, the plan and subsidiary communications networks would be generated.

The point made at Northwick Park, says John Weeks, is that the main communication network really determines the plan disposition and that most of the elements which make up the complex are open-ended. Expansion beyond the presently envisaged Phase III could be carried out increasing the numbers of beds, the area of the laboratories, numbers of theaters, number of X-ray rooms and pathology laboratories, increases in out-patient and accident services, increases in size of animal house—and each of these increases can occur independently and is not dependent on any other increase.



Hank Snoek photos



- | | |
|-------------------------------|------------------------------|
| 1 Maternity unit | 18 Central Kitchens |
| 2 Psychological medicine | 19 Pharmacy |
| 3 Rehabilitation unit | 20 X-Ray: Central supply and |
| 4 Library, lecture hall | 21 Pathology |
| 5 Medical illustration | 22 Shopping square |
| 6 Clinical research institute | 23 Administration: main entr |
| 7 Animal house | 24 Outpatients department |
| 8 Radiochemistry | 25 Accident & emergencies |
| 9 Isolation unit | 26 Supplies delivery |
| 10 Operating theaters | 27 Boiler house |
| 11 Recovery unit | 28 Oil storage |
| 12 Central Wards North Wing | 29 Maintenance department |
| 13 Central Wards East Wing | 30 School of Nursing |
| 14 Central Wards South Wing | 31 Staff residences |
| 15 Chapel | 32 Common rooms |
| 16 Clinical lecture theater | 33 Staff houses |
| 17 Staff dining rooms | 34 Flyover |

The communications spine is a two-level structure which proceeds to and through the buildings with sustained identity. It is fixed in every aspect except length, and proceeds from a nursing school and residence complex at the east end of the site to a central administration building and shopping square from which it spiders out to other buildings in the complex as shown in the site plan. The upper level of the spine is mainly a pedestrian walk and lower level is for service traffic and other services. The service level has electric vehicles which will be used for the longer journeys through the complex. Shorter journeys will be made on foot. There is a third-level tunnel for energy mains in the central, densely populated areas.

It was in the nature of the indeterminate program that the buildings be designed as individual houses for departments. That way, the growth rate of each could respond to later input independently. Departments are arranged in their order of

attachment to the spine so that most communications will be over short distances.

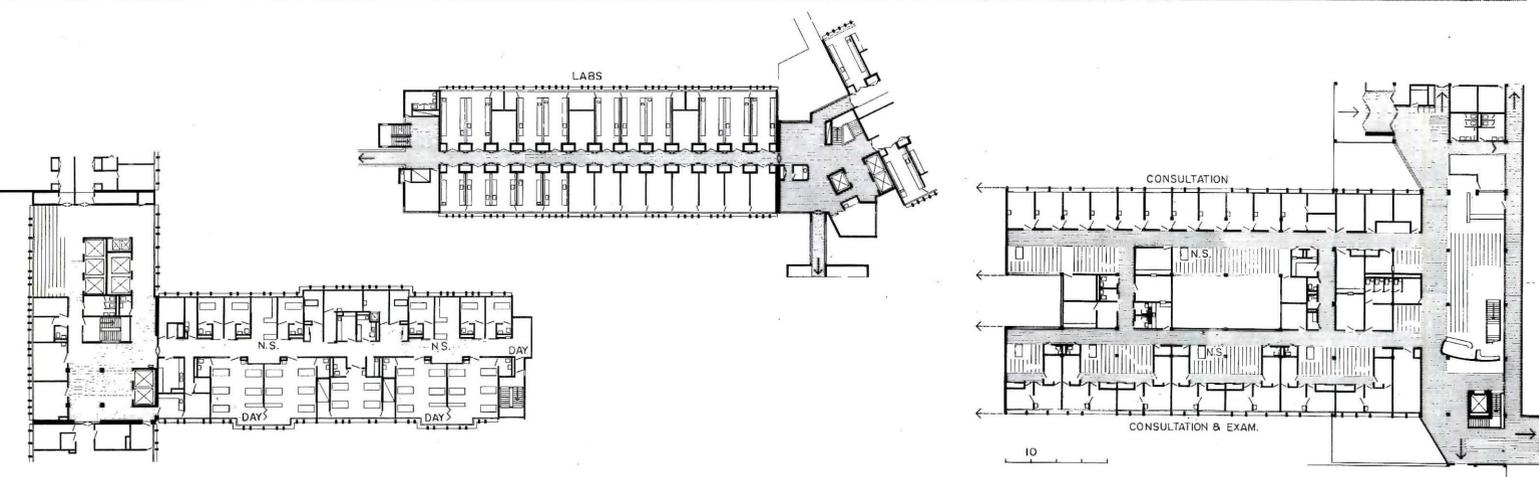
Architecture for change at Northwick Park is considered at two levels of probability. In certain departments—such as laboratories—changes are likely to be internal without a strong likelihood of increase in size. Structures for such departments then are required to have internal flexibility in a fairly fixed envelope. Those departments—e.g., diagnostic and surgical—which are likely to expand markedly in both size and scope are planned for external expansion by addition either of rooms or complete buildings.

The communications spine or street system, since it is independent of the departmental buildings, allows phased programming and construction throughout the system without constraining the order of building in each department. In fact, buildings can be erected and demolished during the life of the complex without halting work in other parts of the network. An-

other advantage is that design teams can proceed simultaneously on separate departments without requiring continuous interplay. The savings in time alone can be enormous.

In general, expansion of the individual buildings will take place in one direction, usually at the end farthest from attachment to the spine or street system. Where various parts of a complex department expand at different rates, such as in a surgical suite, the plan allows for three-way expansion. Vertical expansion is possible in administration areas but is not contemplated for patient-occupied areas.

In collaboration with the structural engineers, a module based on a generalized, fairly small dimension was adopted for general application to the plan. Similarly, a spacing system for mechanical services was developed which would be likely to cater to most needs as the design developed. These early dimensional decisions permitted planning to proceed in the vari-



ous parts of the complex at its own speed and with over-all consistency.

Another aid to concurrent planning of the various parts of the complex was a set of ground rules for providing visual clues as to whether and in what direction a building was designed to expand. Further, the junction points in communication corridors were designed with recognizable clues as to their position in a hierarchy of journey lengths.

"At this point," wrote John Weeks in his 1964 paper on indeterminate architecture (*Transactions of the Bartlett Society*, Volume II, 1963-64), "a distinction became clear between the logic of structural intervals in indeterminate situations and that in normal dimensionally stable situations. The idea of a repetitive structural column dimension, usually the basis of structural geometry, seemed at variance with the idea of free linear development of the building section. The structural slab had a modular base, for repetitive shuttering [form work],

and interior columns could be placed fairly freely. We decided to accept this free interval system in the outer skin supporting frames.

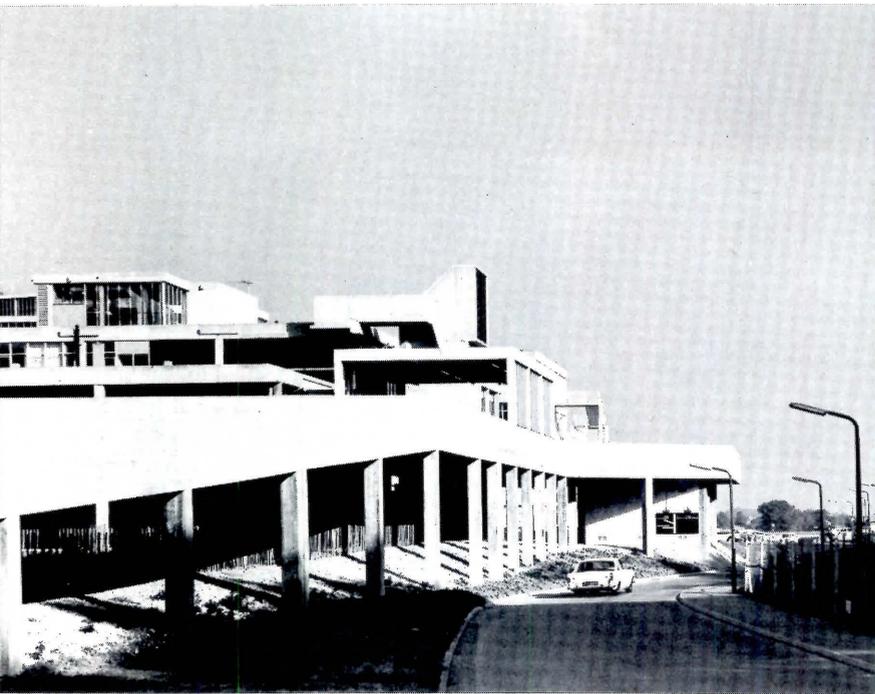
"Criteria for the design of the external skin of the building included the need for a column-free inner face which would enable partitions to be positioned freely, using a single detail for all junctions with the external wall throughout the system. It was decided to use a structural mullion system."

For purposes of economy and structural efficiency, a single mullion element was designed for use throughout the complex for the single purpose of support. In conjunction with stiff-edge beams at floor levels, the mullions are arranged at intervals related exactly to the mechanical load to be transferred. Thus, the intervals are closer together at lower floors and mullion lines are not continuous for the full height of the building. Since partition junctions with the external skin are independent of

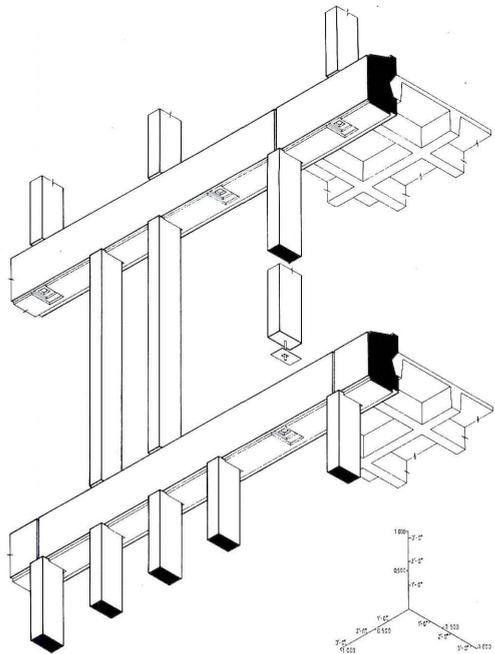
the support system, this mullion arrangement can respond exactly to the loading from point to point, and local loadings find their expression along each elevation.

The visual clue to the growing end of expansible buildings is the substitution of a more regular, non-load bearing interval in the mullion system. Non-growing buildings are distinguished by structural systems that are dimensionally regular.

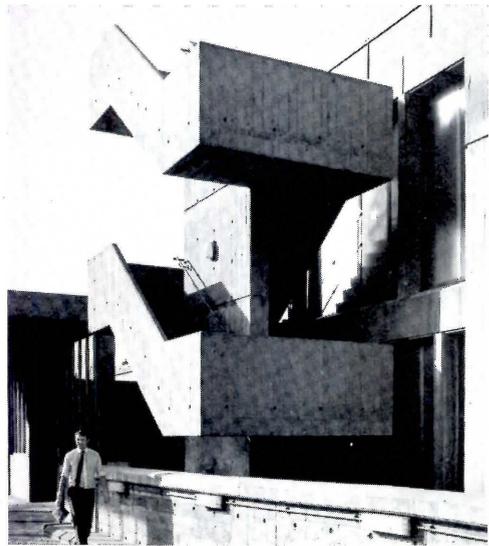
John Weeks concludes the expository paper previously cited with the following paragraph: "In the buildings, we accepted what we regard as the inescapable building requirements which included not only provision for growth and change, but economy in construction and the need to design quickly. We have in fact designed it in detail in 18 months. It has faults and contains compromises; but every system used in it is capable of development. The direction of this development is clearly pointed by the evolving disciplines of an indeterminate architecture."



Hank Snoek photos



Modular structural mullion system for Northwick Park is sketched above right. Photo above shows ramp approach to emergency and outpatient building. Character of escape stairs is shown at right. Below left is part of the waiting space in the diagnostic block. Upper part of the general waiting space in the outpatient department is shown below right. Independence of fenestration from structural mullion system can be seen. Waffle slab and stiffening edge beam are typical.



NORTHWICK PARK HOSPITAL AND CLINICAL RESEARCH CENTER, London. Owner: North West Metropolitan Regional Hospital Board and Medical Research Council. Architects: Llewelyn-Davies Weeks Forestier-Walker & Bor; consulting architect (laboratories): John Musgrove; structural engineers: Ove Arup & Partners; mechanical and electrical engineers: Steensen Varming Mulcahy and Partners; quantity surveyors: Gardiner & Theobald; general contractor: Trollope & Colls Ltd.; interiors: Phoebe de Syllas

The design of large-scale, abstract decorative fountains differs markedly from the consulting engineer's day-to-day pursuits. He is called upon to produce subjective, rather than numerical results, and is subject to criticism as much for failure to produce esthetic results as for failure to produce functional results.

As one discusses water, it becomes apparent that, from a visual standpoint, quantifying water is very subjective. The architect must deal in terms such as "heavy water," "white water," "a great deal of water," "a trickle."

In our experience, we find that the best way to begin to reduce these purely subjective, verbal descriptions of an overall effect to a more concrete workable form is, for instance, to decide what basic effects are desired; to reach understanding of the visual quality of each of these effects; and then to work out a plan of the total display. Further development is through renderings, models, photographs and analogies. When rapport has been reached on the "ultimate" effect, the hydraulics and economics must then be explored before any system design can result.

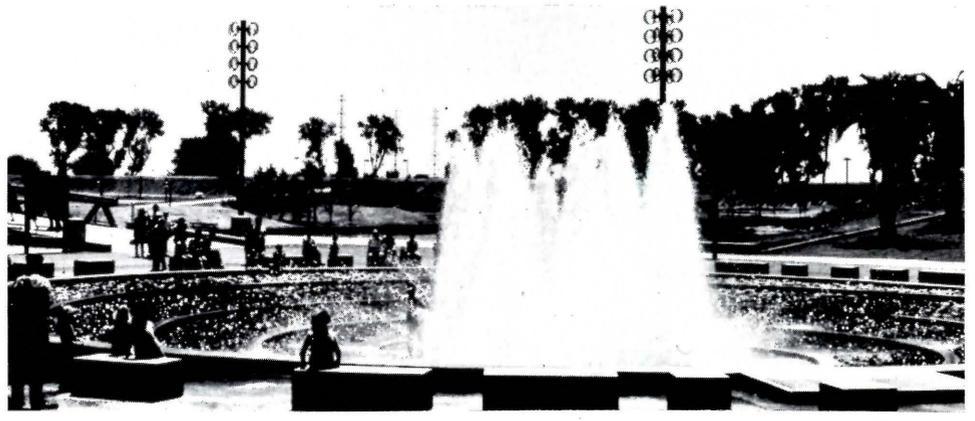
Agreement on effects must precede hydraulic design

Many hydraulic considerations that were once determined empirically or by means of laborious calculation are now readily available in graph or tabular form. By means of these charts, or tabulated data on any of the many commercially available nozzles which may be selected, the engineer can usually obtain a reasonable estimate of the flowrates required. The ability to produce sheet flow over a weir, white water, specific outfall from a vertical surface, or to exert any other specific control over the flow are essentially empirical problems, as there are numerous variables involved with each of these effects. If they cannot be related to previous experience or construction, model testing is often the only way to reasonably ensure the desired effect.*

As one observes various installations, it is interesting to note how subtle, virtually unnoticeable changes in surface texture or geometric configuration of a weir can greatly affect the flow. Small projections on the weir edge can change sheet flow to white water; a small radius on the outside

ACHIEVING EFFECTIVE COLLABORATION IN THE DESIGN OF FOUNTAINS

by Richard Chaix, senior associate
Beamer/Wilkinson and Associates,
consulting engineers



edge of the weir can change a ten-degree angle of outfall to a dead vertical fall.

White water has the quality of imparting additional mass to any given flow rate. The basic difference between sheet flow and white water is in the introduction of turbulence of sufficient scale to entrap air in the stream, which "blows up" the mass of water with air bubbles. This principle is employed on nozzles of the cascade or bubbler type where the introduction of air produces a very solid appearing columnar or conical configuration. Usually it is uneconomical to produce flow depths in excess of two inches over a waterfall type of weir of any substantial length. By utilizing white water, any given volume of water assumes considerably greater apparent mass.

Only when the design engineer and architect have assured themselves that the

desired visual concept has been obtained should detailed economic study and design begin. In many instances, such as the design of runnels and cascades, considerable investigation in the area of hydraulics must be conducted during the design phase, and this must be done with consideration of fully developed grading plans and sections. Depths, widths, in some measure even overall configurations may be affected.

The variables in the cost of fountain systems

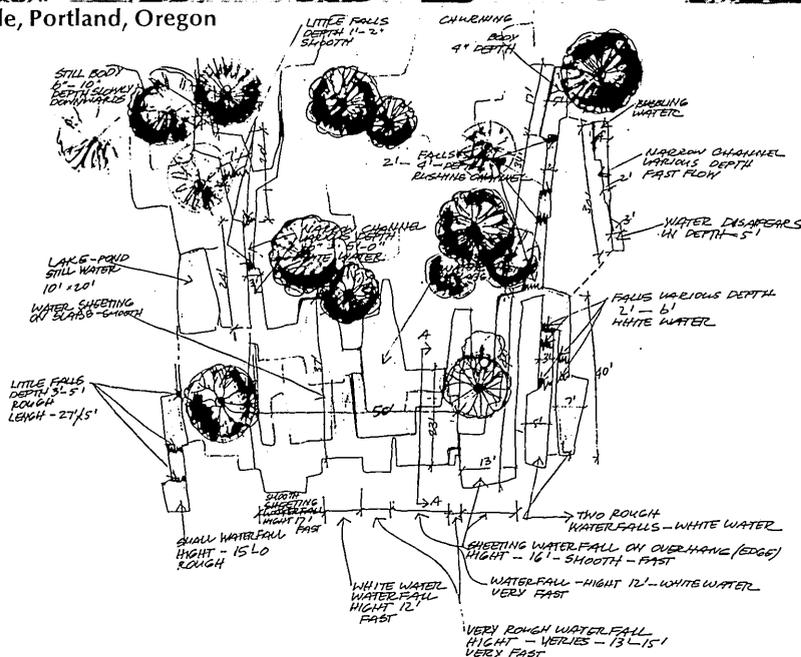
Once the engineer has established basic flow rates, the rough design of the recirculating system may follow. While this system is the heart of the total fountain system, the architect is usually quite surprised to find that it quite often constitutes less than half of the system cost. Lighting, pool filters, skimmers,

*See "Fountain Scale Model Serves as an Engineering Design Tool," ARCHITECTURAL RECORD, March 1969.



Auditorium Forecourt Cascade, Portland, Oregon

The 200 hp vertical mixed flow pump (a type commonly used in irrigation) delivers a high volume of water, 15,000 gpm., at great efficiency and requires a minimum of piping and equipment room space.



The 80-ft. wide cascade (above) developed out of a rough initial sketch (left) indicating still and churning water ponds and sheeting, white and rough water falls of varying widths and heights up to 18-ft. A model, hydraulic analysis and hydraulic testing were used to develop the concept. The apparently massive white water falls are flowing only one to three inches deep—an impressive effect being achieved economically.

Designer: Lawrence Halprin and Associates—Satoru Nishita, partner-in-charge; Byron McCulley, project director; Angela Danadjieva Tzvetin, project designer. Mechanical and electrical engineers: Beamer/Wilkinson Associates.

provisions to fill and drain, make-up and overflow systems, chemical treatment, and other peripheral systems that consume equipment room space and budget money, are unseen, but very necessary elements in a practical fountain system. If the budget must be tightened, it is less obvious if the difference is taken up in these areas.

The most variable peripheral cost is that of the lighting system. The amount of compromise allowable in this area depends on how much nighttime use there is, and whether the fountain design will allow lighting from without as well as, or in lieu of, from within. Floodlighting is generally much less expensive than underwater lighting.

With secondary mechanical systems, the engineer must forewarn the architect of the problems that result from too much economizing. Too much compromise can lead to

almost insurmountable maintenance problems and protracted shutdowns that will lead to more dissatisfaction than visual compromises.

At an early stage the engineer must be able to tell the architect whether or not the particular display or effect desired is feasible within the budget. If not either the effect or the budget must be compromised.

Of paramount importance in the design of the fountain system is economically achieving the water form envisioned by the architect with equipment that performs reliably, efficiently, and quietly under severe and often variable conditions. Further, the many secondary mechanical functions should be visually unobtrusive, and perform reliably and automatically.

The engineer should innovate if this is necessary to produce the desired effect, but

he must stay within the allocated budget. Quite often the feasibility of the whole architectural concept depends upon the engineer's ability and willingness to innovate. Following are descriptions of several large scale projects where innovative, somewhat unconventional application of equipment and materials have resulted in savings of many thousands of dollars, while working as well as or better than their conventional counterparts.

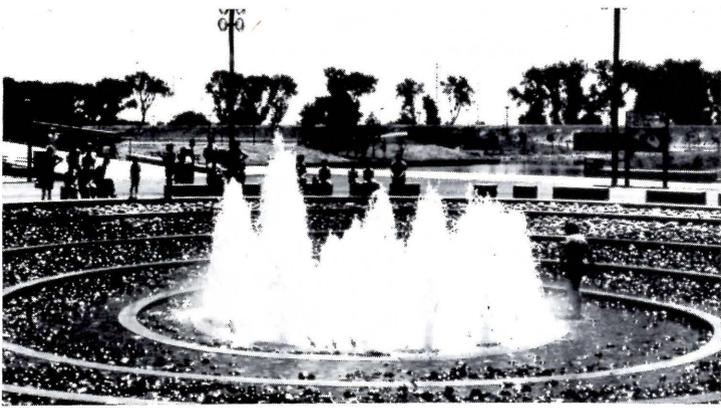
Three different fountains exemplify innovative approaches

An automated fountain for the California State Exposition

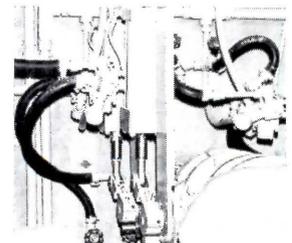
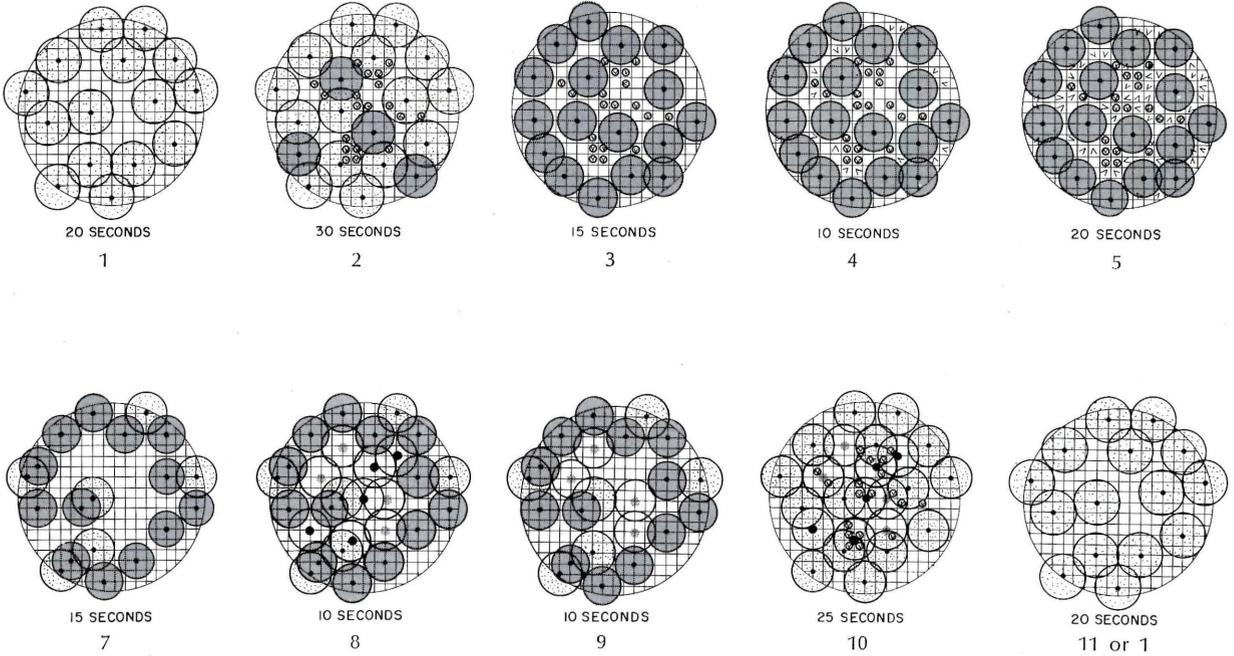
The architect's program called for an automated fountain with considerably greater flow rates than one normally experiences (approximately 7500 gallons per minute).

Fountain at California Exposition and Fair, Sacramento

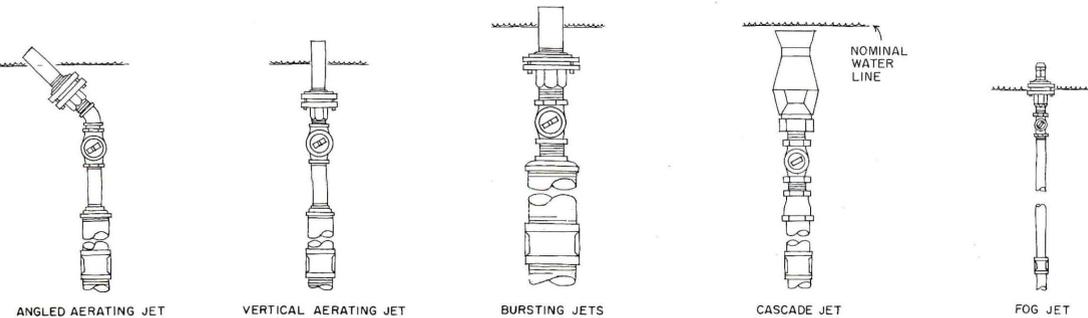
From photographs of various nozzle types in action the designer was able to provide definitive sketches of the 10 phases of this automated fountain. Shown at left are a full cascade jet phase, a phase combining cascade jets with angled aerating jets, and a phase of cascade and bursting jets. The complete cycle runs about three minutes and includes in addition fog or misting jets and vertical aerating jets. Each phase runs from 10 to 30 seconds. The sequence indicated in the drawings begins with misting jets which fill the bowl (1). To this are added some cascade jets up to 15 ft. high and vertical jets up to 30 ft. high (2). Next the rest of the cascade jets go on and the mist jets go off (3). Angled jets are added in four groups at five second intervals to the remaining vertical and cascade jets (4, 5). Then a large group of cascade jets goes off (6) and by a process of further additions and subtractions the sequence builds to a phase of bursting jets up to 50 ft. high playing with cas-



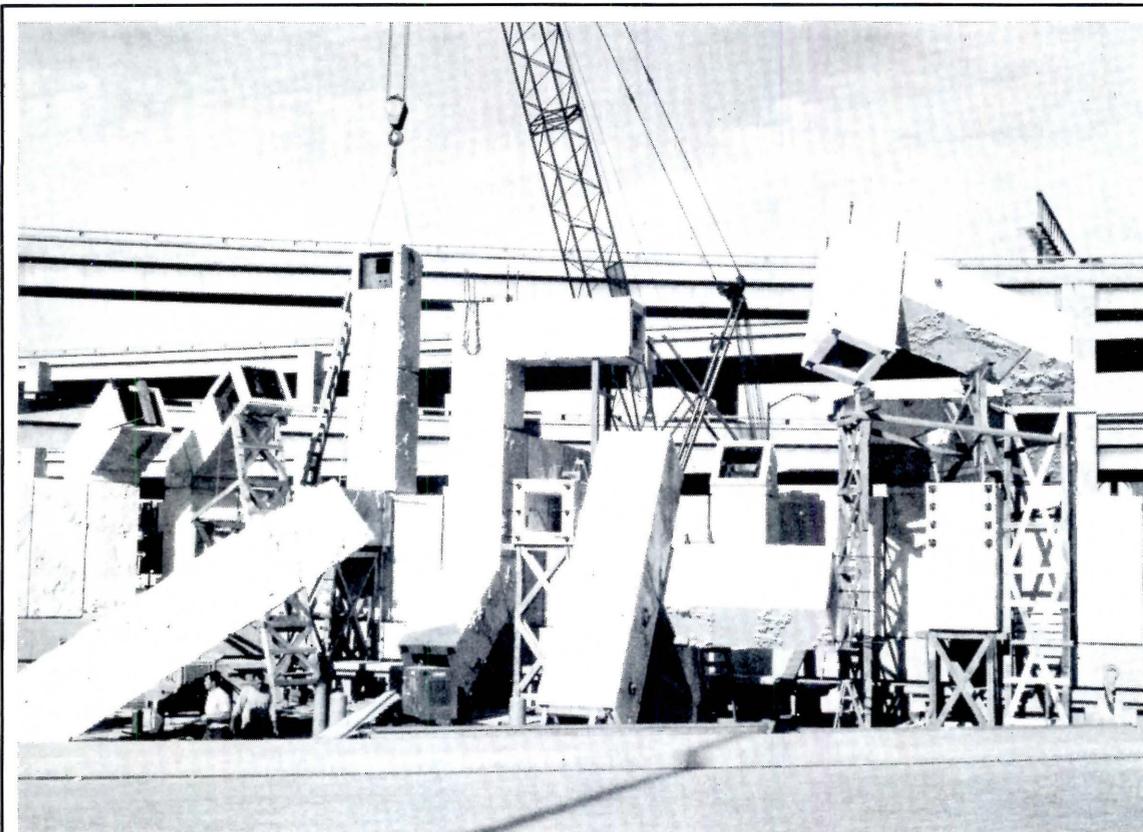
-  MISTERS OR FOG PRODUCING HEAD
-  JLL CASCADE TYPE JET TRYING 10'-15'
-  VERTICAL 25'-30' POSITIONED SOLID/AERATING JET
-  BURSTING JET TO 35'
-  BURSTING JET TO 50'
-  ANGLED AERATING JET (INDICATES FLOW DIRECTION)



cade and misting jets (7-9). Finally the sequence subsides (10) to the initial phase of misting jets (11 or 1). This wide variety of effects is achieved by a dense arrangement of the five types of nozzles in the fountain basin (center). The engineering innovation here is the use of rubber seated, hydraulically-actuated, cylinder-operated butterfly valves (left). Each controls flow of up to 2000 gpm. The more customary use of pilot operated diaphragm valves would have been more expensive and required 35 to 50 per cent more space in the equipment room.



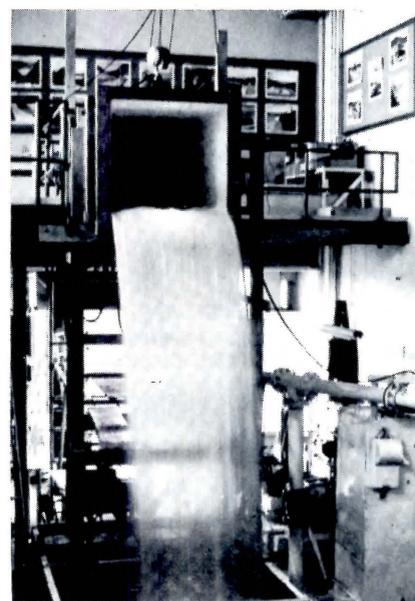
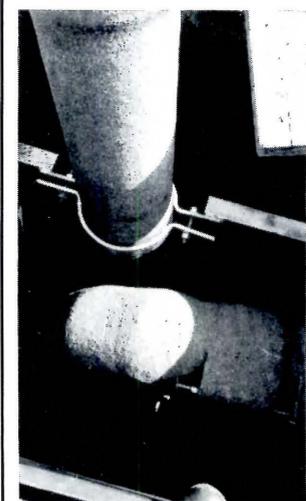
Designer: *Lawrence Halprin and Associates*. Mechanical and Electrical Engineers: *Beamer/Wilkinson and Associates*



This fountain was developed with full-scale mock-ups (below) which the designers and engineers jointly evaluated for visual, sound and lighting effects and for controlling splashing. Mandrel-wound fiberglass pressure pipe (far left) made the design economically and physically possible.

Joint Venture Design Team: Lawrence Halprin and Associates, Chairman; John S. Bolles and Associates; Mario J. Ciampi and Associates. Sculptor: Armand Vaillancourt. Mechanical and electrical engineers: Beamer/Wilkinson Associates.

Embarcadero Plaza Fountain, San Francisco



The automation is usually accomplished with pilot operated diaphragm valves, but if they had been used for this application, either an excessive number would have been required or they would have been unduly large—in either case, an expensive solution. In addition, the types of nozzles employed dictated that under wind conditions only the higher elements be reduced, while the lower elements remain constant. This requirement meant that the individual lines to the high-element nozzles must have two pilot valves each, one for on-off and one for wind-control throttling. The solution, which resulted in substantial dollar savings as well as 35 to 50 per cent savings in floor area was to employ rubber seated butterfly valves, generally 8-in. size, with water actuated cylinder operators. This equipment is shown on page 107.

Portland Auditorium Forecourt Fountain
Prior to our involvement with this particular fountain, for which Lawrence Halprin & Associates were the designers, we had been retained as special consultants to analyze the preliminary design for a cascade type of fountain that required 30,000 gpm. The recirculating system was predicated on using centrifugal pumping units providing a total of 600 hp at the building mechanical room, with 24-in. suction piping and 20-in. discharge piping. The estimated cost was in excess of \$500,000. Our solution which cut the horsepower to 300 hp and saved over \$250,000 was to employ vertical mixed-flow pumping units, as commonly used for irrigation systems; locate the pumping units within and under the fountain display; and eliminate suction piping by means of a concrete sump structure. The Portland Audi-

torium forecourt fountain, engineering-wise, is a similar installation, using a single 200 hp vertical pump mounted over a concrete inlet sump producing 15,000 gpm.

Embarcadero Plaza

This sculptured fountain is comprised of highly geometric, steel-lined, precast concrete shapes, which have all angles at either 27½ or 55 degrees. The installation of steel or cast iron piping within the extremely confined spaces, and accommodation of the unusual bends, would have been prohibitively expensive, if not impossible. But employing a mandrel-wound fiberglass pressure pipe, new on the market at the time, all bends were accomplished at the factory and the 10-ft. sections delivered for the job weighed approximately 60 pounds each, allowing one man to transport and install them.

Automatic doors aid efficiency, safety and security

Installations in the First National Bank of Chicago range from entrances to a computer room, to food-facility areas, to security doors where Brinks handles bulk money.

Pneumatically-operated automatic doors are not merely convenient appurtenances as used in the spaces occupied by the First National Bank of Chicago in their new 60-story office tower. Rather, they provide tangible benefits in the form of: 1) improved employe morale and efficiency; 2) increased safety; 3) better temperature and humidity control in the computer room; 4) smooth traffic flow in kitchen and dining areas; 5) improved security (in the Brink's area); and reduction in door damage.

In all, 35 automatic doors have been installed in various locations on five floors of the building, mainly in kitchen and dining areas. Four stainless steel sliding doors are used in the dishwasher area of the fifth

floor; four single swinging doors are used in the Mid-day Club on the 56th floor; and 15 automatic doors have been provided in executive dining rooms on the 57th floor, including seven single-swing doors connecting food preparation areas and dining rooms and eight sliding doors in the kitchen areas.

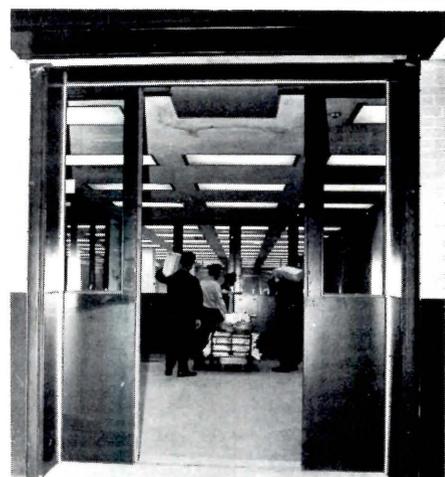
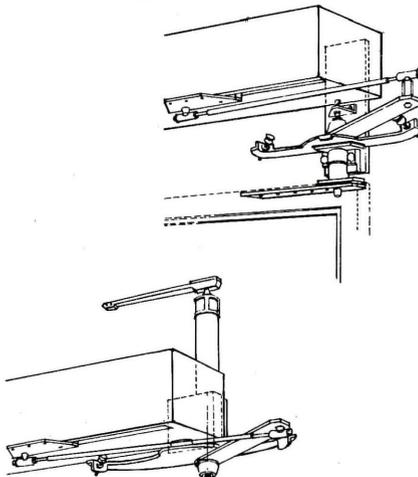
One of the more unusual applications is the use of two pairs of independent sliding doors on Lower Level 1 used by Brinks guards in transferring money. These doors are operated by a guard from a bullet-proof glass booth. The installation is called a "man-trap" because if an intruder managed to get through the first pair of doors, he would be prevented from going farther, and the first pair of doors could be shut.

Four swinging and two sliding doors have been used in the Lower Level 2 computer room. Because of their fast operation, these doors help assure close control of temperature and humidity. The swinging doors are actuated by "carpet" controls, an opening carpet on the approach side and a safety carpet on the swing side. These carpets are 1/2-in. thick and lie in terrazzo recesses flush with the floor.

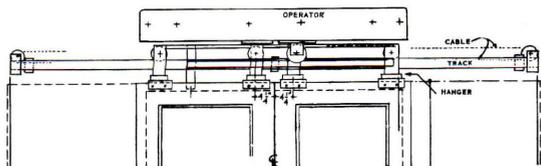
Plans have been made for installation of two automatic doors at street level entrances to the building for the convenience of physically handicapped people.

Door operators are concealed either below the floor or above the ceiling, so there are no exposed operating mechanisms.

Pneumatic equipment was chosen over electric and hydraulic because: 1) it is quieter; 2) it is smoother in operation; 3) pairs of doors can be mechanically synchronized; 4) maintenance is easier.



The Stanley Works (Door Operating Equipment Division)



With bi-parting sliding doors operators and track are covered with aluminum to form the top door jamb. Operators for swinging doors are either above ceiling or below floor. Doors are actuated by contact with "carpet" controls, by push button or by wall plate (in dining rooms, see right).



The strong points of a mechanically-seamed metal roof

Reasoning behind the design of a "seamed-in-the-field" aluminum roofing product and installation tips are given by Kaiser Aluminum's Richard C. Schroter

The ideal roof covering would be a single sheet of material, impervious to water, unaffected by exposure to weather, strong enough to resist pressures of snow or wind, and low in cost. Over the last few years a series of new metal industrial roofing products has emerged that meet these criteria. With this new generation of metal roofing products, the sections are formed into shapes having sufficient rigidity to span between the primary or secondary supports, eliminating the need for a solid deck.

There are a number of mechanical seam closing devices on the market today. A unique type of closure is employed in the Kaiser Zip-Rib system in which an oval hook-like section is closed around a mating round tubular edge. The advantage of such a detail is that the closure machine can perform its function traveling in either direction.

Flat bottom panels provide the greatest coverage efficiency and are the easiest to close around roof penetrations at plumbing vents or skylights. But to achieve a section strong enough to resist walking, snow and wind loads, some stiffening ribs are required. In the metal gauges currently in use for industrial roofing (.032" or .040") a flat width greater than 12 in. does not provide sufficient attachment to resist uplift and is subject to excessive deflection unless stiffened across the width.

A significant advantage of the vertical leg is its adaptability for flashing at eaves or major roof penetrations. A continuous drip angle effectively prevents wind from blowing water back along the roof edge. For extreme weather we recommend compressible polyethylene foam rod to plug the tubular ends of panels.

A common denominator in all of the new-generation metal roofing products is the elimination of through fasteners. The

reason is that even a well-seated through fastener may work loose and produce a leak. Interlocking or snap-in clips which fasten to the structure are designed to hold the roof material in place against uplift, yet provide freedom to expand and contract in the longitudinal direction. Lateral movement is readily accommodated by the accordion action of the section profile.

Another potential source of leakage can be the seams. The pulsating action of wind, plus the natural capillary action of water between closely fitting lap joints, can produce leakage in spite of upturned edges. The addition of a capillary "break" in the form of a groove or recess will prevent this action and most products include some detail of this sort. In snow-prone geographical areas all joints and seams should contain a sealant material because of the possibility of melted snow not draining, particularly when ice dams form. This is preferably a permanently soft pliable material that will not dry out or become brittle.

Where shipping conditions permit, the use of ridge to eave lengths will eliminate the need for end laps, conserving both material and labor for a lower cost, better performing installation. Lengths slightly in excess of 100 feet can be easily handled at the job site with standard hoisting equipment.

Thin, light-gauge sheet has a tendency to distort under loading and the distribution of stresses can be very complex. For this reason, Kaiser Aluminum has made extensive use of the air pressure bag for qualification of its roofing products. This method of loading has the advantage that like wind or snow it imposes no restraint to section distortion. We have found that with sand bags or bricks, there is some unavoidable bridging of the loaded area which can produce significant errors in the measurement of properties.

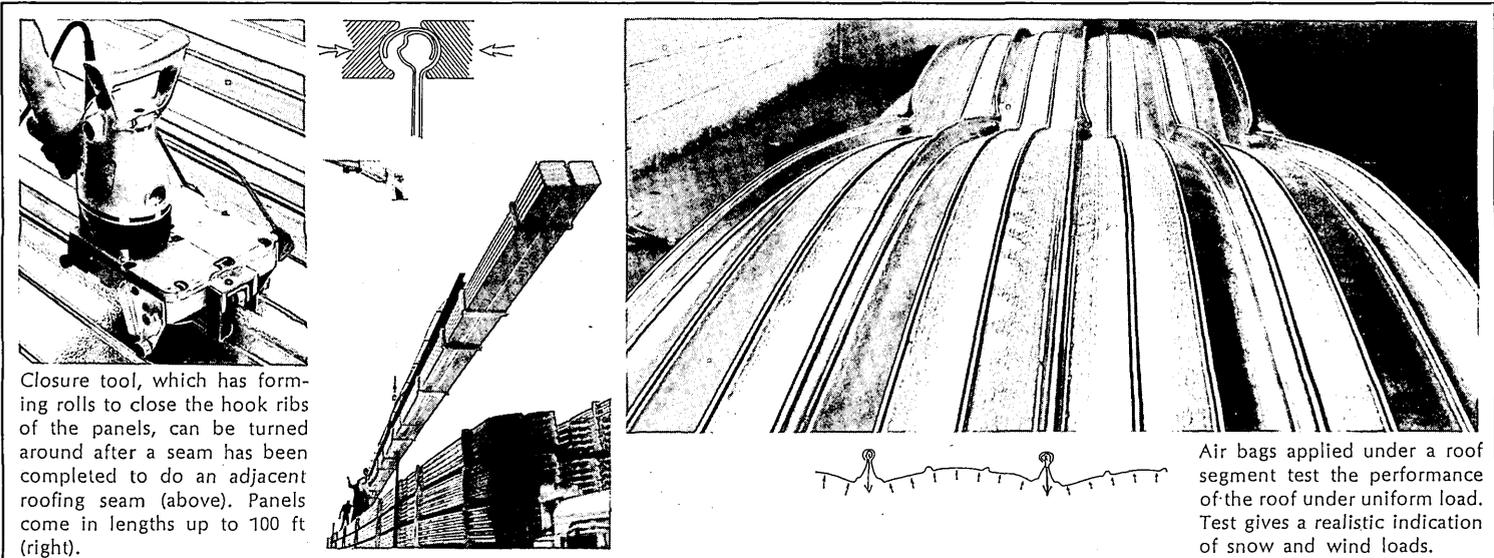
The quarter point loading method is even more liable to give faulty values, particularly in measuring the strength in uplift when the fastener grip or section modulus may be reduced by an upward bow of the panel. This is illustrated below.

Under the load requirements of building codes in the United States, experience has shown that uniform load performance can be adequately accounted for with the use of the air pressure system described. In Europe some failures have occurred in self-supporting systems that were partially attributed to fatigue during wind storms. After a major failure in France in 1957, the "Centre Scientifique et Technique du Batiment" (CSTB), requested development of a test procedure for roofing that would include pulsating stresses simulating wind action. In the September 1965 issue of *Revue de l'Aluminium*, an article by Jean Rovere describes the test conducted at the Centre Technique de l'Aluminium for this purpose.

A. A. Sakhnovsky, Director of the Construction Research Laboratory in Miami, Florida, has found that the only fatigue failures observed have come from high frequency vibration of relatively loose elements where large deflections may be encountered.

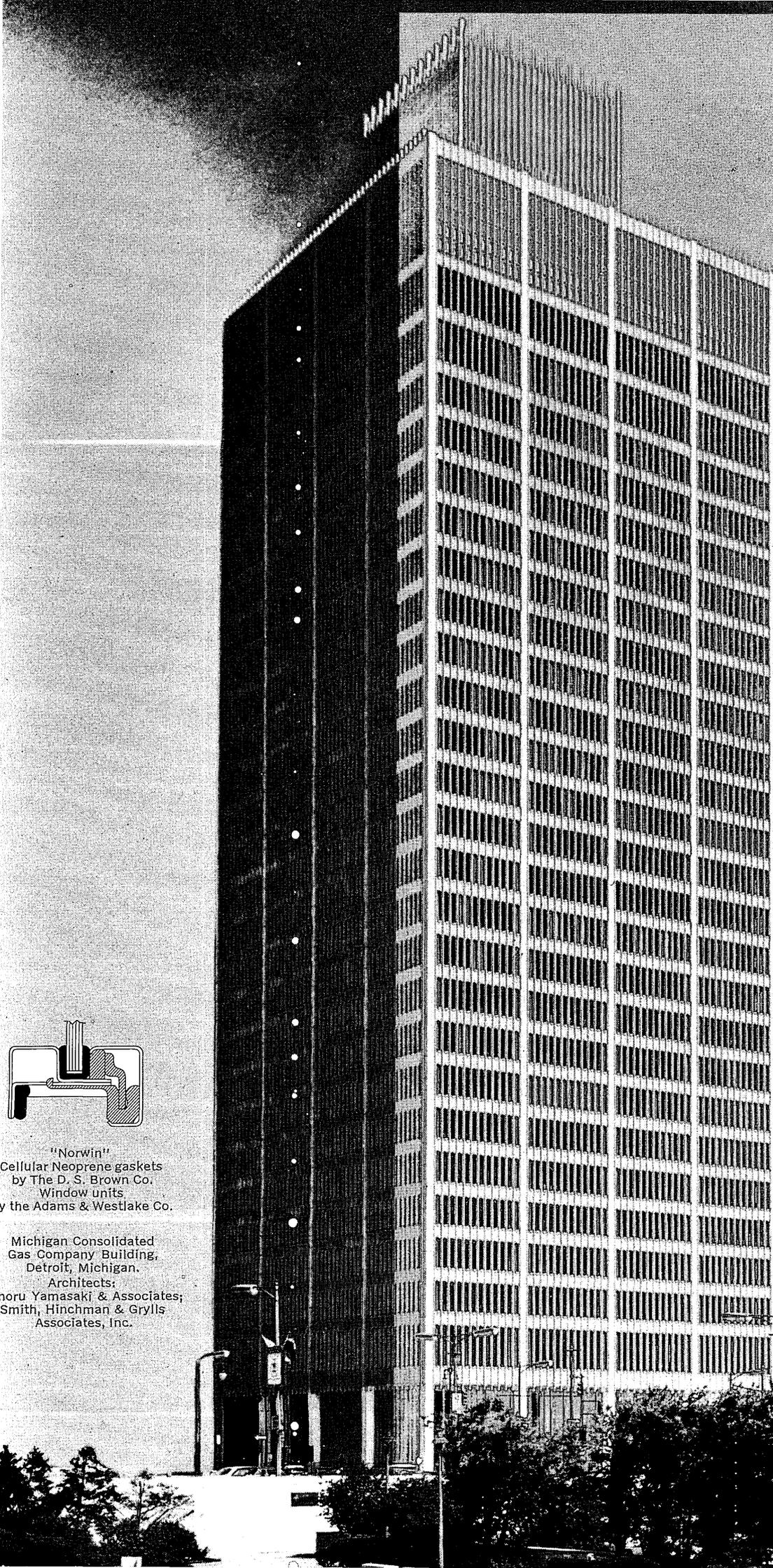
In this country the most severe uplift requirements are those of the South Florida Building Code (Dade County) which reflects the extreme hurricane experience of this area. Roofing materials qualified by test are subjected to: (1) uplift pressure equivalent to twice the wind velocity pressure exerted through an air bag placed between the roof covering and the structural sheeting and, (2) a dynamic test to assure that elements are not subject to flutter.

In addition to structural performance evaluations for code acceptance, we have found it beneficial to conduct dynamic water testing of roof systems to verify weather-tightness under extreme conditions. This type of testing is particularly useful in the design of the perimeter conditions; eave, gable end and ridge details.



Closure tool, which has forming rolls to close the hook ribs of the panels, can be turned around after a seam has been completed to do an adjacent roofing seam (above). Panels come in lengths up to 100 ft (right).

Air bags applied under a roof segment test the performance of the roof under uniform load. Test gives a realistic indication of snow and wind loads.



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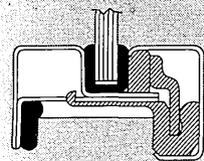
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For more information circle selected item numbers on Reader Service Inquiry card, pages 159-160.

LIGHTING FIXTURES / A line of drop-globe luminaires for a wide range of interior and exterior lighting applications is described in a catalog. The fixtures are constructed of heavy gauge cast and extruded aluminum and are available in a variety of mounting options. ■ Stonco Lighting, Kenilworth, N.J.*

Circle 400 on inquiry card

DUCTBOARD / "Rigiduct Board," a 4-page bulletin, describes a fibrous glass-insulated ductboard which, the bulletin states, has allowed system fabrication cost savings of up to 25 per cent. Rigiduct systems can be altered on site, and weigh one-fourth as much as insulated or lined metal duct. ■ PPG Industries, Inc., Pittsburgh.*

Circle 401 on inquiry card

LIGHTING / A catalog describes a complete line of incandescent-, fluorescent-, tungsten-halogen and mercury-type lamps for residential, industrial and commercial applications. ■ Sylvania Electric Products, Inc., West Seneca, New York.

Circle 402 on inquiry card

FLOORING / A 4-page brochure describes a seamless flooring system available in a wide variety of colors, designs and patterns. A specification chart is included. ■ Products Research & Chemical Corp., Burbank, Calif.*

Circle 403 on inquiry card

CONCRETE BLOCK / A 16-page booklet presents a line of glazed masonry units designed especially for applications where sanitary maintenance may be a problem. Described are the scored, design and standard series. ■ Burns & Russell Co., Baltimore.*

Circle 404 on inquiry card

WINDOWS / A 24-page catalog presents a line of wood window units including double-hung, casement, casement bow, vent, and slide windows. Specifications are given. ■ Rodman Industries, Inc., Rock Island, Ill.

Circle 405 on inquiry card

DOORS / An 8-page brochure describes a line of doors featuring a pre-cured, expanded foam core. Listed are details pertaining to construction features, sizes, and specifications. ■ Amweld Building Products, Niles, Ohio.*

Circle 406 on inquiry card

CEILING SYSTEM / A 6-page brochure describes a geometrically designed ceiling system which incorporates pre-framed acoustical panels and integrated lighting modules. The components drop into a suspension system. Reference charts show load factors and light reflectance for various styles and finishes. ■ Owens-Corning Fiberglas Corp., Toledo, Ohio.*

Circle 407 on inquiry card

BATHROOM CABINETS / A 36-page catalog describes over 200 cabinet models in addition to a complete array of coordinated wall mirrors. A line of bathroom accessories is presented. ■ The Grote Manufacturing Co., Madison, Ind.

Circle 408 on inquiry card

CERAMIC TILE / A 16-page brochure presents a line of tile available in over 44 colors and 32 patterns. Sizes are 1 in. by 1 in.; 2 in. by 1 in.; and 2 in. by 2 in. ■ American Olean Tile Co., Lansdale, Pa.*

Circle 409 on inquiry card

DOOR HOLDERS / A 4-page bulletin contains data describing a line of door holders and stops for interior and exterior doors. Specifications are given. ■ Checkmate, Franklin Park, Ill.

Circle 410 on inquiry card

OFFICE SEATING / A 24-page catalog presents 100 pieces of office seating in modern and traditional styles. The line includes executive and secretarial seating, sofas and lounge chairs. ■ R-Way Furniture Co., Sheboygan, Wis.

Circle 411 on inquiry card

FIBERS / "Fiber Facts," a 12-page booklet, discusses the characteristics, advantages and limitations of all man-made carpet fibers and wool to assist in selecting the best fiber for a particular application. The booklet is published by a multi-fiber producer. ■ Dow Badische Company, New York City.

Circle 412 on inquiry card

FLOORING / A 16-page catalog presents a line of vinyl asbestos floor tile, asphalt floor tile, feature strip, and cove base in a variety of colors and patterns. Brief specifications are included. ■ Azrock Floor Products, San Antonio, Texas.*

Circle 413 on inquiry card

* Additional product information in Sweet's Architectural File

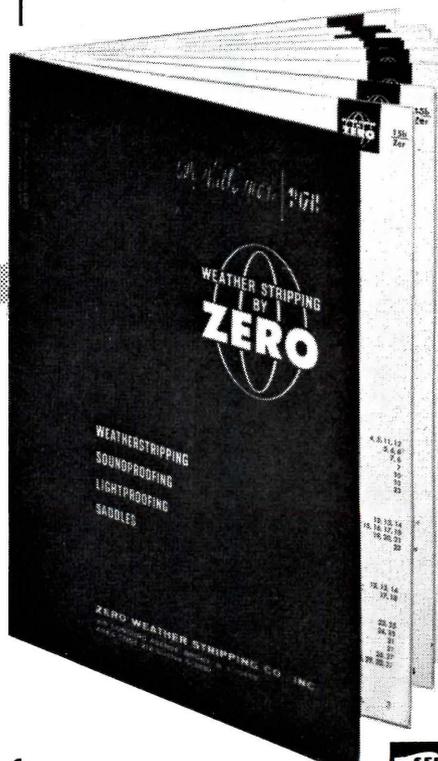
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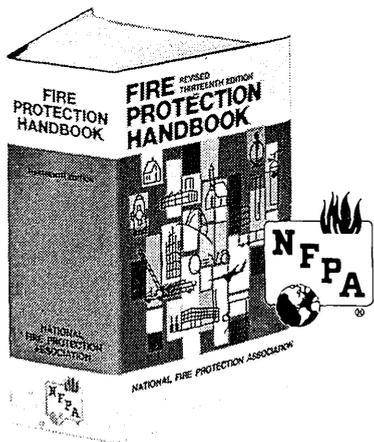
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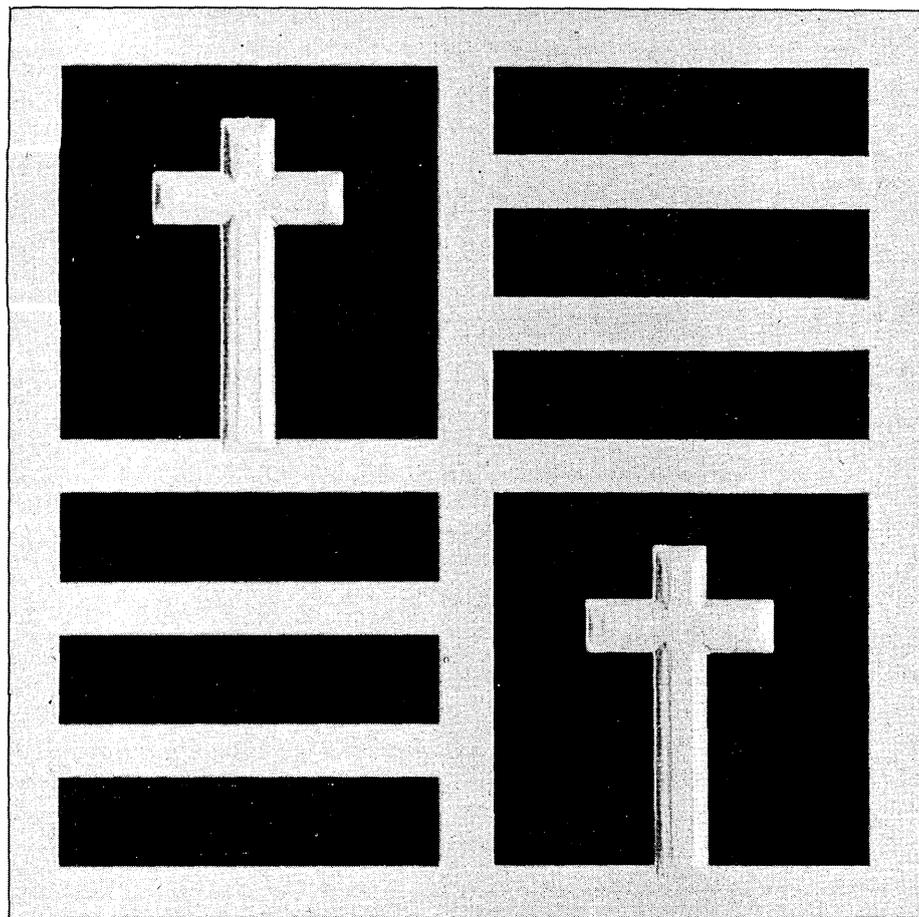


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continued from page 138

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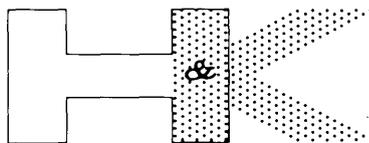
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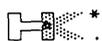


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STEEL FRAME / A 12-page brochure presents a complete line of steel frame including a dry wall frame, frames for trimmed openings, wrap-around frames, frames with hospital stops and others. Construction features, an application guide and complete specifications are included.

■ Amweld Building Products, Niles, Ohio.*

Circle 422 on inquiry card

WALL SYSTEMS / An 8-page booklet describes a complete translucent wall system. Photographs of actual installations show a wide range of design concepts. Featured are decorative moldings which can be applied to the system. Technical sketches describe the basic component structure of the wall system. Specifications are included.

■ Kalwall Corp., Manchester, N.H.*

Circle 423 on inquiry card

HEATING/VENTILATING/AIR CONDITIONING / An 8-page catalog gives general information on a line of industrial heating, ventilating, and air-conditioning equipment. Performance data is given for unit heaters, duct furnaces, infra-red heaters, duct blowers, central station air handlers, and rooftop units.

■ Modine Manufacturing Co., Racine, Wis.

Circle 424 on inquiry card

LIGHTING / A 32-page brochure describes a complete line of round and square recessed downlights. Presented are frame-in kits approved for through wiring, new concrete pour boxes, 300-watt capability round units, a heat lamp plus a recessed adjustable accent light.

■ Lightolier, Jersey City, N.J.

Circle 425 on inquiry card

WASHROOM EQUIPMENT / A 12-page catalog describes a complete line of washroom fixtures including wash fountains, column showers, multi-stall showers, special equipment including a variety of valves and soap-spray systems and washroom accessories such as dispensers, receptacles, multi-purpose units, mirrors and shelves. Dimensions are included.

■ Bradley Washfountain Co., Menomonee Falls, Wis.*

Circle 426 on inquiry card

COMPUTER SERVICES / A 4-page brochure describes one firm's general consulting services available from its computer systems division. These services include business organization, systems and facilities planning, systems design, project management, acquisition studies and special management studies.

■ Westinghouse Electric Corp., Pittsburgh.

Circle 427 on inquiry card

GLASS / "Potentialities of Glass" is a 16-page booklet illustrating seven techniques of using glass, including some recent developments. Prepared by the Stained Glass Association of America, the booklet states that these techniques are applicable to buildings of all types.

■ Ram-busch, New York City.

Circle 428 on inquiry card

FOAM-LINE WALLS / A 4-page data brochure describes an architectural wall system using a urethane insulation with porcelain enamel finish at an installation cost of \$3 per square foot.

■ H. H. Robertson Company, Pittsburgh.*

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* Additional product information in Sweet's Architectural File.



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