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Letters

Calendar

Once again I find myself on the familiar ground of disagreeing with one of your editorials—this time, the editorial in your June 1984 issue ["The ten best of the 1984 Convention in Phoenix," RECORD, June 1984, page 9].

If you recall, one of the resolutions passed at the AIA convention was to deplore the low level of compensation that architects receive. In my opinion, this occurs primarily because clients see architects as a necessary evil—needed to get a building permit. The *average* client thinks of them as part of the problem rather than the solution. Thus clients first try to avoid using qualified architects and, failing that, treat them as draftsmen and pay them a commensurate fee. Remember, I am talking about the *average* client who hires the *average* architect, not Gerald Hines who hires Philip Johnson.

Now why does this occur? One reason is that architects listen to critics like you and attend three-hour discussions on the Honor Awards. They should be going to something that would be more useful to their practice, such as how to design a roof that doesn't leak.

The average client does not believe that design is a problem, even though it may be. Until architects understand that clients want a building that *works* they will always be low professional on the totem pole.

Michael R. Hough, President
MRH Assoc., Inc.
Newington, Connecticut

I was shocked and saddened by the cover of your June 1984 issue. The idea of giving free advertising to Knoll for producing chairs that are totally lacking in beauty and basic design innovations is inexcusable. They are decoration only, without comfort or meaning as art. They are backward and show an elitist disregard of any human feeling except whimsy.

Why are we such suckers for the "good old days?" Why are the '20s copied so lovingly? Where is the new and creative work of the future that is a part of the exciting space age and communications revolution blossoming all around us? Where is the reflection of the inspiring new scientific discoveries being made daily? Where is the attitude that originality of thought in art is a sign of greatness? Where is the real avant-garde?

The one example of a search for this is the Vietnam Memorial in Washington. It is simple and strong and the most powerful antiwar statement made in this century. It does not glorify war, so it aroused controversy, and a flagpole and sculpture of three soldiers were forced upon it. Some people missed the symbolism of the past.

This is the meaning of postmodernism. This is the meaning of the chairs.
Richard W. Snibbe, FAIA
New York City

Normally an Observation such as that given by Iain Mackintosh in the June 1984 issue of ARCHITECTURAL RECORD [page 87 et seq.] would be taken as just another opinion were it not for the way it was purveyed in those pages. Your caption "restoring humanity to design for the performing arts" suggests that all theater design that has gone before is inhumane. Furthermore, Mr. Mackintosh's tone throughout errs a little too much toward the aggressive to ignore without some kind of rejoinder. If this Observation had been made in one of the theater trade magazines, it could be dismissed as a rather lopsided, if not quaint, view of what theater design is all about. However, since no regular forum exists in your magazine for opposing views/equal time/consensus of opinion on an issue as technical as this, it alarms us, as theater consultants, that your architectural readers (probably not questioning the authority of your editorial content) may therefore conclude that Mr. Mackintosh's view represents that way to the future rather than an aberration of modern theater design.

Although there have been some clunkers in recent memory, theater design as practiced in the last 20 years throughout the world represents a positive response to the many forces (technical, social, economic, etc.) that shape it. Mr. Mackintosh nostalgically shows prints of old "bullpen" theaters. Sightlines, patron comfort and (perhaps most pertinent) safety were not well-developed criteria in these spaces. One of the reasons that older tiered opera-house space gave way to modern balconied theaters was the development of advanced steel and cantilever construction techniques to eliminate the column that always seemed to obstruct vision. Another reason was that these older theaters were very inefficient in terms of seating layout. Each tier could reasonably support two rows of patrons before sightlines became abysmal. Just look at those engravings and you will see proof of this. It is virtually impossible to build the 1,500- to 3,000-seat theater demanded by today's performing arts economics using the tiered approach. Sightlines to the entire stage from the side tiers of Carnegie Hall or the more recent Minneapolis Hall or Fisher Hall are poor and get worse

Through January 22
African Masterpieces from the Musée de l'Homme, at the Center for African Art, a new museum at 54 E. 68th St., New York City.

October 11-15
Designer's Saturday, show room exhibitions and seminars, in New York City. For information: Designer's Saturday, 911 Park Ave., New York, N. Y. 10021.

October 17 to January 6
Chicago and New York: More Than a Century of Architectural Interaction, an exhibition of graphic materials and architectural fragments; at the Octagon, the American Institute of Architects Foundation, 1799 New York Ave., N. W., Washington, D. C.

October 19
Biennial design awards program sponsored by the Oregon Chapter of the American Society of Landscape Architects, for landscape architects, students and associated design professionals; at Forest Hall, Western Forestry Center, Portland, Ore. For information: Awards Program, Oregon Chapter ASLA, 1637 Oak St., Eugene, Ore. 97401.

October 30 to November 20
Mediterranean Indigenous Architecture: Timeless Solutions for the Human Habitat, an exhibition at Buell Architecture Gallery, School of Architecture, University of Illinois at Urbana-Champaign.

November 1-2
"Excavation Failures—Causes and Prevention," a professional meeting sponsored by the Architecture and Engineering Performance Information Center, at the University of Maryland, College Park, Md. For information: AEPIC, University of Maryland, 3907 Netzerott Rd., College Park, Md. 20742 (301/935-5544).

November 1-3
Conexion '84, interior design exhibits and seminars, at Atlanta Market Center. For information: Atlanta Market Center, 240 Peachtree St., N. W., Suite 2200, Atlanta, Ga. 30043 (404/658-5672).

November 2
"Strategies for Getting Ahead," a workshop for young design professionals sponsored by the Boston Society of Architects Women in Architecture Committee; in Boston. For information: Melissa B. Bennett (617/451-0200).

November 15
"Indoor Air Pollution," a course sponsored by the Yale University School of Medicine; at the Mary S. Harkness Auditorium, New Haven, Conn. For information: Office of Graduate and Continuing Education, Yale University School of Medicine, 333 Cedar St., P. O. Box 3333, New Haven, Conn. 06510 (203/785-4578).

The evidence piles up that you've got to learn about computers

Not long ago, faithful readers will remember, I was writing on this page that I hoped to get to early retirement before I had to learn much about computers. More recently, I've been confessing (admitting?) that was a not very foresighted attitude. And lately, I confess, I've become something of a convert—an uncomfortable convert, mind you, but a convert. One reason I've become a convert is that I've seen what computers have done in our editorial offices. Almost all of the editors (that almost is for me) now type their copy into a computer terminal. It is edited on a computer terminal. The type specifications are entered on the computer, and we tell the computer where each block of copy should appear and where and how big the photos and drawings should be. And then we push a key on the terminal and other computers do their thing and what we see next is a proof that is very close to the pages you see. Now mind you I'm not sure I like it—in the old days (say a year ago) we could send copy to the printer and see how it "fits"; today if it doesn't fit *you* have made a mistake. We've even had our first real computer disaster—parts of Peg Gaskie's Building Types Study in this issue simply disappeared into the electronic ether (it seems a disk in which her hard-written words were stored didn't do its thing)—and she had to write those pages over. (A writer's nightmare, as you can imagine.) But I can understand our system and its benefits in terms of both cost and flexibility—and at least one of our editors feels that it is easier for him to write on the computer, just as an increasing number or architects (mostly young) are reporting that their creative design work seems to "flow" better with a computer stylus in their hands.

Only a few weeks ago, I was having lunch with an old friend whose firm is up to about 60 people and he said that while he was using computers for accounting work and writing specs, he hadn't yet explored computer graphic systems for producing drawings—and I found myself describing animatedly the systems I'd seen and/or experimented with "hands on," as they say. If you've entertained any doubt about how much of the work in an architectural office can now be computer-aided, I refer you to the special 32-page insert on page 49 of this issue, entitled "A Guide to Computer Software for Architects and Engineers." It lists over 350 architect-specific software programs, under six different headings: Office Management, Project Cost Analysis and Control, Project Scheduling and Management, Space Planning and Facilities Management, Computer-Aided Design and Drafting, and Architectural Engineering. It will not be light reading, but we earnestly believe it will be valuable reading and a very useful reference. The overwhelming point that comes from studying this guide is the number of sources available now for computer software (and the computer hardware that runs it), and the number of functions important to any architect that can be performed by a computer system. If you're "waiting for costs to come down," you'll find that time's up; you'll find listings in the Guide that make economic sense for even small firms (indeed much of the software was written by architects in small firms for their own use). Computers can't make you a better designer, but they can speed up, make more efficient, and lower the costs of almost everything you do in the office. If there is one thing that I especially hope comes out of the Guide, which we've labored over for nearly a year, is that it makes clear the opportunities opened up by computer systems—even the relatively simple systems that the small firm can afford and the neophyte can learn to use without formal training. As I've said before on this page, the way to get started is to start. You might begin on page 49. *W. W.*

Fourteen years of interstitial design

Fourteen years ago, the initial application of the Veterans Administration Building System emphasizing interstitial service space was incorporated into the design of Saddleback Hospital in Laguna Hills, California.

The concept of interstitial service space has since influenced the design of hospitals, both VA and private, here in the United States and abroad. And its application has also been incorporated into the design of non-hospital structures, such as hotels and laboratories, that could benefit from the system.

The key to all interstitial service space applications has been the accessibility of services for construction, maintenance, repair, and change. The service zone has therefore been constructed with an over-all working platform which doubles as the ceiling subsystem in functional areas of the structure. This service ceiling provides a working platform, an acoustic and thermal block, support for partitions, and a fire retardant. With the added capability of being cut and patched with hand tools, the service ceiling allows easy penetration and closure for duct openings and pipe connections.

With interstitial design the question of increased cost was a consideration. The building itself would necessarily be somewhat larger and the cubage would be higher because of the interstitial space. But trade-offs in cost can be anticipated.

The service ceilings constructed for the 300,000 sq. ft. Froedtert Memorial Lutheran Hospital in Milwaukee, Wisconsin allowed work to go on simultaneously in interstitial and functional floors. Rather than having to erect scaffolding to install utility and air conditioning runs – causing an interruption of continued work in the functional floor areas – the service ceilings supported men and materials during installation. After completion of the hospital, operational maintenance in the interstitial service areas is being conducted without distrubing patient care activities on the floors below.

According to a study by the VA, the additional cost of interstitial design is totally offset by savings in construction expenses.

Contractors interviewed say the system can cut construction time by as much as 20% and also save 15 to 20% on labor costs of mechanical installation. They say fewer coordination drawings are necessary, more trades can work simultaneously, and fewer change orders are processed.

The VA hospital in Loma Linda, California, for example, came in two months ahead of schedule with labor costs cut by 25%. Service ceilings went in fast with gypsum pours reaching 5,000 sq. ft. per day.

The service ceiling assembly most often specified – over 6 million sq. ft. – consists of Keydeck® Truss Tee subpurlins and Keydeck® Reinforcing Mesh manufactured by Keystone Steel & Wire. Formboard and poured gypsum complete the assembly.

Keydeck Truss Tees are welded beneath, or between main structural beams for support, while Keydeck Reinforcing Mesh adds strength and uniform structural soundness to the poured gypsum.

The open web design of Keydeck Truss Tees allows the subpurlins to be strongly embedded into the gypsum concrete resulting in a greater load carrying capacity and minimum deflection.

Keydeck Reinforcing Mesh meets ASTM tensile, bending, and coating requirements; and conforms to Federal Specifications.

The resulting service ceiling assembly is fire resistant, provides increased insulation capabilities, and helps control noise.

Additional information and detailed literature about Keydeck service ceiling components along with a complimentary truss tee deflection calculator can be obtained by writing the Construction Products Manager at Keystone Steel & Wire Company, 7000 S. W. Adams, Peoria, Illinois 61641. A toll free telephone service is also available for inquiries: 800-447-6444 (in Illinois call 800-322-2632).
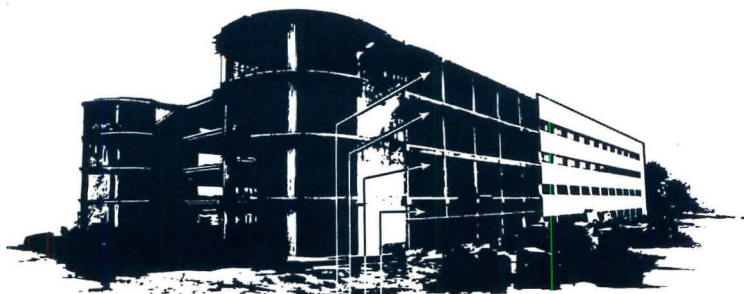
Interstitial service ceilings on four levels

Froedtert Memorial Lutheran Hospital Milwaukee, Wisconsin
Architect:
A joint venture of Stone, Marraccini & Patterson and Brust-Zimmerman
Construction manager:
A joint venture of Findorff and Hutter
Service ceiling components manufacturer:
Keystone Steel & Wire Company
Service ceiling fabricator:
Anning-Johnson Company

Keystone Steel & Wire Company

Circle 7 on inquiry card

SARA opens membership to associates

Some hope in sight for handicapped confusion

The Society of American Registered Architects has created the Associate Member category for persons working for architectural registration. This change fills a vacuum between student membership, opened several years ago, and full professional membership. An associate is defined as a person working toward architectural registration for and under the direct supervision of a registered architect.

The new members have all the rights and obligations of members except the right to vote, to represent the SARA as a delegate or to use the Society to identify himself or herself as a member. Dues for associate members are $50 per year. For additional information, call Stan Banash, Stanley D. Banash and Associates, 5940 North Neva Avenue, Chicago, Ill. 60631 (312/763-5763).

Furniture burned for research

A catalog of fire data on furnishings is the outcome of researchers in the National Bureau of Standard's Center for Fire Research burning 28 different types of furnishings and measuring how fast each item burned and how much heat it released. Added instrumentation enabled researchers to determine how much smoke was generated and whether nearby materials or furnishings also would be ignited. The study was supported in part by the Department of Health and Human Services for guidelines for selecting hospital and nursing home furnishings. *Fire Performance of Furnishings As Measured in the NBS Furniture Calorimeter—Part I (NBSIR 83-2787),* $14.50 prepaid from the National Technical Information Service, Springfield, Va. 22161. Order by PB #84-155639.

Improved access to government buildings for the handicapped is moving a step closer to reality—and with greater uniformity—with the release of final standards for Federal buildings. Although there is no timetable so far for full implementation, the new document is another step in the long drawn-out process that began 11 years ago when Congress established the Architectural and Transportation Barriers Compliance Board and seven years after the board was charged with formulating nation-wide uniform standards for the design, construction and alteration of Federal buildings.

The 84-page document, published in the August 7th *Federal Register,* represents an agreement on standards between the Department of Defense, the Department of Housing and Urban Development, and the U.S. Postal Service, all of which had developed their own standards, along with the General Services Administration, which develops standards for its own buildings and for other Federal agencies. The overriding goal is to provide "ready access" and to facilitate the use of Federal buildings by the handicapped. The regulation covers all buildings that come under the Architectural Barriers Act, typically structures directly funded by the Federal government. It excludes, though, facilities used or operated by "able-bodied military personnel," and it does not cover Federally *assisted* construction, such as school district buildings.

Released initially for comment about a year and a half ago, the standards were largely patterned after earlier standards created by the American National Standards Institute, a private organization.

The final document basically represents detail refinement in such areas as maneuvering clearances for doors—the new Federal standards are actually six inches less than the ANSI standards, representing a cost savings, although the Federal rules say they "prefer" the more generous ANSI numbers—corridor dimensions, accessibility to bathroom stalls and phone booths, the last worked up in cooporation with the late Ma Bell.

The four agencies and the board

will continue to work up access standards for structures in between buildings, such as stairways and bridges, constructed independently of the buildings themselves and for which standards have not been clearly defined as yet.

The final document also incorporates language that explicitly acknowledges historic preservation concerns. The Advisory Council on Historic Preservation will advise agencies in cases where changes proposed to improve access for the handicapped would threaten to destroy the architectural integrity of historic buildings.

Some critics would have preferred a wider use of accessibility standards in, for example, residential housing, according to the document's summary. One national organization wanted 10 per cent of all units to be accessible to wheelchair users who require most of these special features. But the summary said five per cent is a more appropriate figure since wheelchair users constitute less than one per cent of the nation's population, according to several surveys. *Peter Hoffmann, World News, Washington, D. C.*

APA announces planning awards

The American Planning Association is now accepting applications for its expanded national planning awards program. The program is being reinstituted on an annual basis after a one-year lapse to recognize outstanding achievement in planning. The deadline is November 8, 1984. The categories include a comprehensive planning program or process and/or a specific planning project or ordinance; distinguished leadership by a professional or citizen planner, elected official and/or planning firm or agency; and innovation in infrastructure planning. For more information contact Sara L. White or Joyce Berman at the American Planning Association, 1776 Massachusetts Ave. N. W., Washington, D. C. 20036 (202/872-0611).

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is compatible with a wide range of computer peripherals, and the industry-standard UNIX® operating system allows you to choose software from a vast library of application packages. All of these features increase design and drafting productivity, and mean more creative time—and more profits—for you.

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Computers:
What some of the smaller offices are doing

A survey shows micros taking the lead and some of the successes and problems with three popular models selected by the author

By Karolyn Schuster

Lawrence Cook and Joe Taylor brag about the obvious improvement in the quality of their firm's client proposals brought about by their year-old microcomputer. The Falls Church, Virginia, architecture firm estimates it now spends only about one-quarter as much time as it used to in going after work and it does so more effectively because of the customized, top-quality proposals produced on its in-office computer.

In Charleston, South Carolina, architect Steven Thompson says his computer is enabling him "to play better 'what if' games. What if we have 10 per cent fewer openings along this side of the building? What if we substitute one building material for another? What if we spend the money in this area instead of here? We have a better handle on building cost and performance and we have it earlier than we could without the computer."

Jim McManus, architect, says the Connecticut architectural firm of which he is a senior partner and manager of technical services produces a weekly one-page worksheet on its office computer for every project where someone has direct chargeable hours. The print-out on everything from hours worked and labor cost to percentage of fee used to date and estimate of hours left to complete enables the firm to maintain an up-to-the-minute watch on all projects, make the necessary comparisons with budgets, fees, and personnel schedules, and institute appropriate corrective action or adjustments.

In San Antonio, Texas, architect Craig Allen has a problem with a concrete slab raising up in an existing building. A water leak that was causing the soil to expand has been arrested and Allen is now using his computer to monitor the slab and to make periodic testings to determine when the repair should be made. Such analysis without the use of a computer would be complex and take "huge chunks of time," according to Allen.

And in Richmond, Virginia, architect C. Page Highfill says computers have allowed his firm to "take into consideration more of a client's needs in determining what we can do to help run and maintain his building" after design, construction and occupancy. In one instance, Highfill's firm is helping a building owner with multiple properties schedule by computer the painting of individual offices so that all are completed routinely on a once-every-four-years basis. For a racquet club owner, Highfill is using its office computers to handle the club's member billing.

There is little doubt that the computer has arrived in the American business and professional office. But then, we had all been expecting that. The futurists and forecasters had all been expecting that. The futurists and forecasters had all prepared us for the high-tech, high-speed world in which computers would dazzle us with their capabilities, freeing up huge blocks of our workday for more productive and creative tasks.

We were all expecting a revolution, of course, but— something a little more remote
We were expecting room-size mainframe computer systems housed in environmentally monitored laboratories and cosseted by cadres of lab-coat-clad technicians. What we were not expecting was this television-size machine sitting on our own desks in our small offices in small towns and cities across the country. We had envisioned the computer as a work-aid only for large companies who could afford the specially trained personnel to operate it and climate-controlled space in which to house it. We didn't foresee the computer becoming user-friendly with architects in a four-person office.

The current news in computers is micros more often than mainframes (see RECORD, July 1984, pages 37-41). The language is English more often than BASIC. The operators are professionals with two-finger-typing skills more often than technicians. And the products are the traditional and commonplace vehicles by which business has always been conducted—letters and proposals and spreadsheets and pie charts.

As recently as a decade ago, there were few computer fans bold enough to predict its move into architectural offices. As a profession, architects are not the likely candidates that, say, engineers are. The work of architecture, architects would be the first to tell you, is too "creative" to be computerized. But that was not the only stumbling block computers had to clear on their way into architectural firms.

The computers we were accustomed to seeing were too difficult to operate and too costly to buy to be considered as viable, practical office equipment for most architects. True, the giant firms with hundreds of architects on staff and multi-million-dollar projects could afford the education and the purchase price of the computers of a decade ago. It wasn't until the computer became an easy-to-operate compact machine with a price tag below the annual salary of a good secretary, that the bulk of the nation's architects, most of them working in small offices of fewer than 20 persons, began to consider the computer.

Today, architects are using desk-top computers to speed proposals, edit promotional letters and direct mail pieces, track accounts receivable and accounts payable, schedule personnel, and control inventory. Such "back office type" tasks are considered a logical and wise first application for computers newly introduced to any small business office.

But architects are also using those same computers for such uniquely architectural tasks as specification writing, project scheduling, structural-design computations, energy-consumption analyses, life-cycle projections, geotechnical assessments, alternate design evaluations, and automated production of working drawings.

The reports from individual architects vary. Some rhapsodize ecstatically about their marvelous micros; others are cautious and guarded about the capabilities. Some have made the computer—and its programming—an after-work preoccupation; others admit they still approach the machine hesitantly. Some are into complicated in-house programming; others willingly make changes in their office operations to accommodate off-the-shelf programs and their very specific requirements. Some embraced the computer willingly; others admit that they're hoping to slip into early retirement before being forced to put their hands on one.

Now that computers have become familiar to many designers, how do those designers use them?
You've already heard by now of all the glamorous, sometimes frivolous, jobs a computer can do with sufficient technical and financial backing. For this report, some not-so-technical architects in small offices across the country were surveyed to find out how they are using their micros to perform slightly less glamorous and definitely not frivolous tasks.

Move a microcomputer into an architectural office, plug it in, and what's the first thing you produce on it? Most architects interviewed will say that word processing was the first application, and word processing to architectural offices means specifications. Harry Mileaf, a computer expert and director of technology and product planning for McGraw-Hill's Sweet's Division, expects that almost 70 per cent of all architectural firms will be doing some specification writing on computers by 1989.

"The specification situation can be a real irritation," says Craig Allen of Craig Allen & Associates in Texas. "There's always something transposed, changed, overlooked. It's an area of considerable human error. The computer can help eliminate that error." Because 80 to 90 per cent of his business is with a single cafeteria chain in San Antonio, it is important to Allen that his specifications "hold solid." And to hold solid, they have to be unequivocally clear.

Using a computer to produce specifications assumes the presence within the computer of a master specification, or catalog, of all product information, from which the specifier can draw in preparing the specs for an individual project. In some cases, architectural firms have developed their own master specification over years of practice. A typist can then be hired to put that specification into the computer. That, in itself, can be a time-consuming task. One company says its master specifications were so extensive that it took six weeks of day-long typing by a secretary "whose fingers really flew" before the information was stored and available within the computer. In other cases, architects purchase software such as MasterSpec, which is published by the American Institute of Architects, and adapt it for their own use.

"The reason we bought the computer in the first place was to eliminate the clerical nightmare that cutting and pasting had become in specification writing," says Jim McManus, of Stecker LaBau Arneill Inc. "It took us six to eight months to get over 1,000 pages of our master specification in place and another six to eight months to get it working well.

"We also subscribe to PSAE Master Spec and that was fed into the computer. We did fairly extensive indexing of catalog lists by number and title. Wood windows, for example, were broken down into such categories as casement windows, then broken down again by different manufacturers.

"The editing process was a hassle but, now that we're producing specifications on the computer, I wonder how we ever managed without it. We have improved the over-all quality of the specifications and the content of the document itself. It's more customized and there are fewer typographical errors and less duplication."

Specification writing is an obvious choice for the introductory application for the architect who is a first-time computer user because of its repetitive nature. Computer consultants universally agree that it's these repetitive, tedious tasks involving a great deal of boilerplate text that produce the greatest savings in energy and time from the computer.

"We pulled our computer out of

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the box and put it immediately to work on specifications," says architect Warren Goodwin of Warterfield Goodwin Associates in Nashville. "It did what we wanted and produces very good-looking specs using the manufacturer's format. We've been able to produce specs in three or four days for a $1.6-million renovation project that would have taken us three to four weeks previously. We've eliminated all the clerical work—that's history. Using the computer to produce specifications also gives us a default system. Our master spec has everything in the world in it so you can just read through it and take out what you don't need.

"If we had nothing else running on our computer but specifications, it would have paid for itself by now," Goodwin says of the machine he purchased in October 1983.

Glenn S. Orenstein, director of engineering computer applications for architects and engineers Metcalf & Eddy in Boston, has told construction-industry audiences that "the big advantage of computers in specification writing is speed. Computers can assemble specifications very quickly and revise and print them very quickly, a significant advantage since specifications always seem to be written under a deadline. A cut-and-paste capability is built into the computer so you have a rapid revision capability and easy addition and deletion of the text."

After words and numbers are conquered, the other possibilities open up
Some architectural firms, even though small in size, have taken computerization a step or two further than others—either because they got involved with computers earlier or because of the enthusiasm of the architects involved.

These firms have integrated the computer into a wide variety of business, construction, and design tasks. The extent of this integration can be seen in the offices of Dennis Davey of architects Dennis Davey Inc. in Tolland, Connecticut. Davey bought his first computer, an Apple II with a printer, for $2,500 back in 1979 when, as he recalls now, "most programs for the personal computers were games, the word processing program was very limited, and the spreadsheet program didn't exist." He spent hours learning to program and made frequent trips back to the store where he had purchased the Apple but it was nine months before he had the computer up and running.

Today he still has the original Apple II, which has been upgraded many times and is used by his secretary. For himself, Davey

walked into a computer store in mid-1983, saw the same company's Lisa computer, and bought it on the spot, spending $12,000 for the hardware, software, and printer.

He says he now works in a "paperless office" and virtually "anything I need or want to do I can with the Lisa."

As evidence, consider the fact that Davey's one-man office (Davey describes the staffing as, "a secretary, the computer, and me") produces client and prospect presentations, preliminary and schematic designs, and advertising layouts for a print house that include finished copy, construction drawings, specifications, flow charts, project scheduling with critical path analyses, project cost estimates with financial computations translated into graphics and bar charts, invoicing, billing, correspondence, and energy calculations—all with the use of computers. "Without computers, I would need at least one draftsman which I don't have or need now."

For the drawings, Davey has pre-made standard drawing sheets with border and title filed in the computer along with a master file of standard details and schedules such as for doors and windows. He estimates that he uses the computer-stored file for about 20 per cent of his standard details currently. But he expects to get that number to 50 per cent eventually.

On specifications, Davey uses the PSAE Master Spec in which he correlates the Master Spec number (0800 for windows, for example) on the construction drawings with the specification itself. "Because the note number on the written drawing is referenced back to the specification and to the written document, the marriage between the specification and the written document and the construction drawings is virtually complete," says Davey.

The "what if" games he plays with the Lisa are legion. "I plug in the utility rates and ask, what happens if I change the wall R value to 10 from 20? Or what if I change the quantity of glass on the south side? The computer tumbles out the energy consumption difference in dollars."

Davey doesn't believe, however, in computing in isolation. "I use it as a marketing tool. I bring clients into the office for a demonstration of what I can do: I produce a floor plan, then flip it over; I do an elevation, then change from brick to wood horizontal siding; I move rooms and furniture around; I show them how fast and how accurate I can be with my computer.

"Okay, so it's a little razzmatazz. But the clients react to it. They like

to be associated with someone who is forward-thinking; they can see how the computer makes me more flexible and faster; they get the impression of someone who is up-to-date, not lazy. I know I've gotten jobs because of it."

Both price and understanding what computers can do may be the deciding factors
The five staff members in Highfill's Virginia firm each have their own Radio Shack TRS-80 Model IV computers on their office desks (the Model I's each had been using are now in their homes). The firm also has a color-graphics CAD system. "The use of the computer is directly proportional to its distance from the desk," says Highfill. He himself feels comfortable enough with the computer to produce a newsletter of advice called SCIP (Small Computers In Practice) for architects, engineers, and interior designers interested in using smaller computers in their practices.

But it was just seven years ago that Highfill, turned off at the $50,000 price tags for mid-size computer systems he saw in his first shopping trip, had pretty much decided that computers were out of his price range. One day he was buying flashlight batteries in a Radio Shack when he "moseyed on back to a computer display in the rear of the store" where a painting contractor and his secretary-bookkeeper were running a general ledger program.

"I was surprised at the things this computer could do and the fact that the software cost $99," recalls Highfill. "I was confused at first, couldn't understand the tremendous price gap. I spent hours in that store before I was convinced."

Even after he'd purchased a TRS-80 Model I, he wasn't confident enough to move it right into his office. "I took it home first and kept it there for a couple of weeks. I put my personal checkbook into it. Then I took it to my accountant's house for a couple days. Finally I took it into the office.

"Often," says Highfill, "we use new equipment wrong when we first get it. We let it imitate the old equipment it is meant to replace. With the computer, at first, we let it imitate a typewriter in producing specifications."

Today, Highfill's firm has moved far beyond the typewriter stage in learning to use all the computer's capabilities in producing its specifications. There is a master specification that breaks products down into small files. The master specification has a masonry category, for example, and there might be 27 subcategories, all in separate files. The specification writer does his editing on the

computer screen, selecting and deleting those products he has chosen, and by the time he has finished the editing, he has, in effect, also proofread the specifications. The office secretary takes that computer disk, runs through the spelling checklist, and then prints it out.

The results: Highfill says the computer-produced specifications have been found to have a high degree of accuracy and an in-house study found that the firm was saving 60 per cent of the time needed to produce specifications compared to seven years earlier.

But specifications were only the beginning. Highfill says the computer is involved in virtually every stage of his company's work.

For marketing purposes, the computer is used to create and assemble all letters, all news/promotional articles on firm projects, three or four newsletters a year, regular mailings to approximately 1,000 clients and prospects, and all project proposals. Secretaries don't participate in proposal preparation in Highfill's office. All the proposal ingredients are assembled by the person making the proposal decisions.

When the firm gets to the interview stage with a client, it uses the computer project management program to perform and print out all job scheduling and cost estimating information. Once a prospect becomes a client, Highfill's firm sets about gathering a wide variety of detailed information on that client for storage in the computer. For an office project, for example, the computer file would include information on how many conferences are held by the client, what furniture is currently used, the dimensions of desired work space, whether soundproofing is needed, which employees should be located next to which others, the flow of work (Where does the work in your office come from? Where does it go?), what material is wanted on floors, etc. A combination of computer software programs is then used to develop a spreadsheet cost estimate. Land cost can also be inserted to compute a return on investment for a client based on anticipated income.

The computer also has had an impact on the company's working drawings: "We're able to get a lot more information in our drawing notes and more of the boilerplate in the specifications," says Highfill. "Notes are filed in a standard note file by the computer. The computer delivers that note to you maybe 47 times with no rewriting involved. There is a tendency to be more specific with notes because you only write them once. For the contractor, *Continued on page 35*

the advantage is that the note says the same thing every time. There's no confusion. The computer also helps to lighten the load on the drawings. You can do a simple line drawing, for example, and explain that it's brick. You don't have to draw it in as brick."

These days, drawing is where the interest is but the micros are not always ready

What about using the computer to draw? It's the inevitable and logical question from architects. And it remains the area of greatest controversy. While competition and technological developments have brought the computer hardware itself way down in size and in price over the past decade, there are still some application gaps when it comes to software.

"More and more designers are using the computer but the amount of computer use is still slight," says Sweet's Mileaf. He sees the lack of a full and complete range of software as one reason, adding that "over half of all software suppliers have five or fewer programs available." One of these software gaps appears to be in the area of high-quality drawing capability for microcomputers.

Architects who have shopped for computerized-drawing software report a double-edged problem: either the quality of the drawing that the tested software will produce is too poor for architectural requirements or the price of the drawing equipment is too high.

"The speed of microcomputer graphics is very slow compared to the $100,000 systems. But we're looking to spend $20,000, not $100,000," says Jim McManus, of Stecker LaBau Arneill Inc., in explaining why his firm does not yet have graphics capabilities for its working drawings. "Within a year, I predict we'll see systems priced under $20,000 that do have sufficient speed and capability."

"The $150,000 system we'd like to have is too costly," says Ernest Barbee, senior architect for Beckstoffer & Associates of Boston. "I don't see us in computerized drawing unless our firm with its 12-person staff grows in size or that system drops below $50,000."

There are firms that have done drawings on micros— but not without compromises

"What we have on our LisaDraw is not an architectural CAD package," admits Goodwin, at Warterfield Goodwin Associates Architects, of his supplier's micro program. "It can't do everything—there's no automatic dimensioning and there's no stock inventory of such things as doors and windows. You have to

draw in the elements, generate duplicates, and then cut and paste on the screen."

Craig Allen, who had the success with monitoring the concrete slab by computer, uses the same LisaDraw system as Goodwin. He admits there are disadvantages but cites these advantages: "It produces drawings that look good to the client—there's no redoing or erasing—and you can make changes very easily. We had an owner who wanted to see the building with a tile instead of metal roof. You punch two keys and make the change."

Architect Jonathan E. Coxwell, who describes his firm of Coxwell Miller Levine Wyttenbach Architects as "to my knowledge, the only architectural firm in Montana with a CAD system," recently produced his first drawings for bid on his new IBM PC. The software he is using was on display at a Los Angeles computer show he attended and the software creator eventually spent four days in Coxwell's office getting the system operating. For everything but the chair (hardware, software, plotters, etc.) the firm spent just under $30,000.

"It's a two-dimensional system and I think the time will come when we will want to move into three-dimensional but we have had experience accessing to a mainframe. I think we'd be more comfortable with a smaller CAD system in-house and accessing a larger three-dimensional system as needed," says Coxwell.

"You can't get hung up on the idea that 'this machine will do it all.' We don't produce drawings 100 per cent on our CAD system. We use profile door/finish/window schedules and then paste them on. It's easier to plot our details on a CAD system at random and then cut all of them them apart and paste them up."

The lack of three-dimensional capabilities on lower-priced CAD systems is a disadvantage mentioned frequently by the architects who use them. The size of the work sheet is another. Because the screen shows the designer an 8 1/2 by 11 sheet, it is impossible to view the entire drawing at once and the computer user has to work at the project in sections.

"This type of system is particularly valuable if you're working on an 8 1/2-by-11 detail that you'll use again and again. Let's say you're doing a 20-story office building where every floor except two is identical. That's when this kind of system can pay off," says Steven Thompson, of Charleston Architectural Group. "But this region doesn't do a lot of large-scale office work. Most of our

projects are highly detailed and highly specific. I'm not sure we would get maximum use out of a CAD system."

Another consideration in introducing CAD within individual offices is that office's attitude toward working drawings: "Architects often look at their working drawings as almost an art form. There's a lot of time and energy and personal identity that goes into them," says Jon W. Davis, president of Sunlight Homes, a passive solar home designer and builder. "The problem is that all this time and money makes hand-done working drawings expensive and the client can't afford them. Most homes being built today are not being designed by architects and expenses like this is one reason. We look at working drawings as a tool and a tool only. We show the client the drawing and tell them 'we want you to modify this house.' They love it. And it doesn't cost us anything. Changes are easy enough to make."

The flexibility to make easy changes should be an advantage of any type CAD system

Architects who are using the computer to produce working drawings admit a natural reluctance to make changes or modifications on hand-done drawings. One architect says, "You don't want to erase or move things on a completed working drawing because, let's face it, you'd mess it up. A computer can make that change instantaneously and produce a new set of drawings with that change in seconds."

The flexibility to make changes in working drawings is a major advantage to CAD that is cited by those who work with computer systems. Many say this ability to deliver to the client what he wants fast can be a great help in gaining client confidence and approval.

One architect admits that "sometimes it helps to just sit a client down in front of your computer and 'show' him some of his options. You can change the roofing material, show him different room layouts, show him different siting options—that we have his best interests in mind."

"The disadvantage of all this flexibility is that once the client sees how quick and easy changes are, he may be induced to make more changes," says architect David Schaff in Plymouth, Michigan.

While micro's ability to draw improves, the real advantages will be speed in systems integration

"The spotlight always seems to be on computer graphics at every round table meeting or other group discussion that I attend," says Sweet's Mileaf. "And why not? This

is not only where all the glamour is, but it is the design office's biggest expense.

"Unfortunately, it is not the easiest way to get started with computers, nor is it always possible for the computer to pay for itself in this application as far as production savings is concerned."

Mileaf says that graphic systems is one area where software costs *appear* to have plummeted in the last couple of years from six figures to as low as $1,000. "Unfortunately, when you go below the $30,000 to $50,000 range, the systems' limitations are inversely proportional to the price," says Mileaf. "You get what you pay for. This is not a criticism. These low-end, inexpensive systems are long overdue, and probably are the only systems that most design firms can afford. And the vast majority of design firms are very small. The low-end graphic systems that run on the popular personal computers can be used in other applications that are cost-effective and they might be worth the experience gained."

Mileaf reports that in 1984 computer-aided graphics software has replaced accounting software as the software available in greatest numbers from suppliers. But he also reports that only 7.3 per cent of computer users have graphic systems.

"The pattern of software availability still does not seem to match the buying pattern," says Mileaf.

Part of the interest in putting computer-aided graphics and computer-aided design within the reach—technically and financially— of all the nation's architects is the tremendous potential for improved productivity.

"The advantage of the computer is not only in processing but in storing information very cheaply. One of the basic rules of computing is that the more broadly you can integrate a range of activities, the more cost-effective the applications are likely to be (for example, when you integrate engineering and cost analysis with the drafting function)," says William J. Mitchell, professor of architecture and head of the Architecture/Urban Design Program in the Graduate School of Architecture and Urban Planning at UCLA. "It's a straightforward extension of a drafting system to count instances of items, to measure lengths of walls and ducts, etc., automatically. Having extracted that information, the system dumps it into a file in the computer where it is sorted and processed to produce things like bills of material."

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"User-friendliness" is the biggest factor in the phenomenal growth of computer use

When market analysts attribute the rapidly increasing presence of computers in business to their plummeting cost and soaring capabilities, they overlook one significant factor: the language. Computer manufacturers found it was easier to teach computers English than to teach potential customers BASIC. Suddenly the "alien" machine speaking a foreign language was "user-friendly." "Mouse" devices eliminated the need to type commands on hardware keyboards, while touch-sensitive screens and software packages incorporated menus and prompts that made mistakes less likely. The die had been cast.

Architects working with microcomputers in their offices in the past had to first acquire an understanding of the intricacies of computers and their programming. Today, architects can use their microcomputers efficiently and effectively without knowing virtually anything about the way they work.

How familiar architects are with their machines depends a great deal on when they bought their first computer and how personally interested and intrigued they are by the computer's engineering and operation.

Architect Warren Goodwin admits he has no background in computer technology and had no exposure to computers in his student days at Georgia Tech University, from which he graduated in 1971. He had access to a computer in his Nashville office but admits, "I was afraid to touch it for fear it would blow up or dump everything it had stored.

"The construction industry as a whole is slow to change," says Goodwin. "It's very tradition-minded and so am I. I don't want to destroy the way construction is practiced. But I can see how we can enhance those practices with computer applications. With the computers, we might be winding up in the same place as before—we're just getting there more quickly."

In the Falls Church, Virginia, office of Lawrence Cook & Associates, none of the five architects had any experience with computers and none had owned or operated one before Cook saw a one-hour computer demonstration at an AIA conference.

But the firm is located in a residential area that limits the size of the physical structures and the three-story building it occupies is as large as it can get. "To grow, we knew we would have to find a way to accomplish more in the space we had—and that meant

computerizing—or we would have to rent or build new office space in another location."

The company decided on the computerization route. It bought a Lisa from the first shipment of the machines into the Washington area and, relying on the training tutorial within the machine's software, had it turning out documents within an hour.

"Time is what costs in a professional office," says Cook. "We couldn't afford a lot of time spent learning a computer system without producing anything." Today, that year-old computer is being used 10 hours a day on the average of 5 1/2 days a week and sometimes as much as seven days. Flexible work scheduling by the office staff maximizes the use of the computer.

Craig Allen and his secretary both had completed an introductory course on computers at a local university before they bought their first computer in March 1983. "In spite of the course and in spite of being really interested in computerizing, my secretary had apprehensions. It was frustrating to remember the commands, and when you got stuck, it took time to figure out how to get out." A second computer is more user-friendly and although Allen says his computer background helped in understanding the basic principles of the new computer (loading disks, etc.), "mostly it made me appreciate the ease of the new operation."

The quantum leap in ease of operation of smaller computers has been most evident to those architects who have worked with computers at both ends of the spectrum. The reader will remember the example of Dennis Davey who spent hours learning to program his 1979 micro, took nine months to have it up and running, and then in his first nine months with the updated model had paid the entire $12,000 price tag.

That experience is typical. Jon W. Davis, a New Mexico builder of solar homes, said it took him months and months to learn to use an older micro but only a couple of hours to have a newer model in operation.

Thompson, of the Charleston Architectural Group, said he invested 200 to 250 hours of effort at night and on weekends in learning the different programs before he got his old-style computer operational. Even then, he found it quite cumbersome with different commands and procedures for each program he wanted to use.

Some architects report that they got to know their computers on a personal after-work basis before introducing them into their daily operations. For more than a few,

this meant plugging in a computer in a corner of their house or in a basement workshop and simply "playing" with it for a few weeks. Their reasoning: they learn to feel comfortable with the machine without the pressure of trying to produce something on deadline or under the glare of co-workers.

If you haven't tried computers yet but want to, here are these architects' recommendations

For those architects who are just entering the computer marketplace, the architects who have already been there have some very specific advice:

•Know in advance precisely what you want the computer to do in your office—what tasks, what volume, what speed, what quality.

•Know who will be using the computer in the beginning and what their computer experience and "comfort level" is. Most buyers recommend that you involve the potential user in the buying decision. Example: take along the secretary who will doing the the word processing when you visit the store and talk to the sales staff.

•Choose the software that comes closest to meeting your stated needs. *"Software first, then hardware"* is the usual buying rule since it is the software that will determine what the hardware will produce. The software package will also specify the range and types of hardware on which it will work most effectively. Caution: watch out for single-function, or dedicated, software that performs only one task. You don't want to spend enormous amounts of money for a word processing program that can't perform mathematical computations or do cost projections, for example.

•Watch the system in operation. If you want to produce spreadsheets, insist that the salesman produce a spreadsheet with the same software and on the same hardware as you are buying. You may decide you need a more sophisticated software program—or one easier to use—or a higher-quality printer for the final copy. You don't want to get the equipment set up in your office and *then* find it doesn't produce what you want in a form you can use.

•Get your hands on it. Sit down at the machine and operate it—even if it is merely to produce a letter or a column of numbers. You want to get a feel for the keys and for how the computer responds.

•When you do get the computer into your office, use it first for those operations that your office does most frequently, that take the most time, that are most repetitive, or that are most prone to error. That's why most architects start with word processing or specifications. It is on

such tasks that the speed and accuracy of the computer are most impressive and most helpful. And a good first experience goes a long way toward building confidence in the first-time computer user.

•Buy to meet your current needs but with some view to the future. You want a computer with sufficient internal memory and storage and speed to accommodate your growth in volume and your expansion into new areas.

•Pay first attention to the major manufacturers for a general idea of what is available and consider local supplier support in making a decision. With the competition in the computer market, many of the machines—and manufacturers—in the marketplace now might not be around in five years. A local supplier who knows the equipment he sells and is accessible can be a great help through the first hurdles of computerization as well as in any upgrading or expansion moves in the future.

The best source of information and advice probably is other architectural firms of similar size and in similar practices. The microcomputer software industry is approaching an estimated $3 billion and it has over 2,000 participants so it's easy to get confused. You might also go with some proven software leaders. Many smaller architectural firms have found all sorts of applications for the better-selling software packages. For example, Lester P. Glass, AIA, president of New York's Glass Kronland Associates, insists you would have to force him against the wall before you could get him to give up his "two very, very favorite programs," both of which can "carry me from specifications through cost control and database management" and both of which can be interfaced.

If you haven't tried computers and don't want to, you are— at the moment—not alone

All the advice from fellow architects on how and what to look for in computer equipment makes one significant assumption: that the architect in the small office, or even in the large one for that matter, *wants* to computerize.

That, one quickly learns, can be a huge, and even rash, assumption. There seems to have been and there continues to be considerable foot-dragging by the architectural profession in the area of computerization. Some say the dividing line falls about age 40 or 45. Any architect younger admits, however grudgingly, that he'll probably sit in front of a computer screen himself someday. And the older architects are, in many cases, wondering if they can possibly slip

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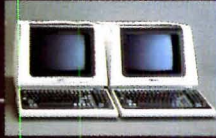
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into early retirement to avoid having to confront a computer in their lifetimes.

Some of the reluctance is understandable. Architecture, as a profession, is focused on the creative and unique rather than the mechanical and uniform. There is a specter of design standardization and a fear of boring, repetitive, computer-generated buildings rising up all over America. There is a lack of conviction of the value of a computer to processes that should involve individual expression.

Some of the reluctance is even justified. Computer companies have not exactly fallen over themselves in producing software and hardware tuned to the architect's needs, interests, and habits.

"There are a lot of energy programs available, for example, but they're not interactive programs. They're not designed for the way architects work," says architect Stephen Metsch of Grant Pedersen Phillips Architects in Santa Barbara, California.

"In fact, there just isn't much software designed for the way architects work. I don't blame the manufacturers. Architects are way down on the economic ladder in terms of disposable-income potential. And there aren't that many of us who are prospective customers—with, maybe about 30,000 eligible ones in the entire country. And no two architects ever agree on anything. I think if I were developing software, I'd forget about architects, too, and go with doctors or lawyers."

**Removing the reluctance
to use them is
the necessary first step**
That is if there is to really be any mass move of computers into architects' offices. "We've got to face the fact that most of what we do on a day-to-day basis is not very creative," says Ernest Barbee, of Beckstoffer & Associates in Boston. "Most of what we do is a matter of doing business. Very few of us sit at a drafting table all day 'being creative.' What I want from the computer is for it to suppress the time spent on these business type tasks."

But even within his own office, Barbee hasn't found unanimous enthusiasm for the computer. "I'm finding resistance even among the younger architects," says Barbee, who is 45 and blames himself for not taking the time to sell the idea of computerization to the other architects in his office. "Initially we tried to get everyone to spend one hour a week with the computer. We didn't care what they did during that hour—games, the household budget, anything that interested them. The idea was to get them

involved with it."

Coxwell borrowed computers from his supplier, set up one on each office desk and conducted his own school for the five architects in the firm. Three of them have since taken college-level programming courses. "We encourage them to bring their kids in on weekends and use our computers—they can play computer games, draw pictures with our CAD system."

**One of the biggest hurdles is
getting over the idea that
computers block creativity**
Architect Glass, of Glass Kronland Associates, can't explain the lack of enthusiasm among other architects for the computer but suggests, "I think they feel it's a lock on their creativity. I have two degrees in painting and sculpture and I find the computer one of the greatest liberating pieces of technology." Glass has become so enamored of his computers that when he leaves his office with its IBM computers for the country every weekend, he takes along a portable Compaq computer.

"Some architects have told me the computer would hurt my creativity," says Schaff. "But I have found the computer very stimulating. It robs you of the tedious, boring jobs. I think a computer makes you think faster and harder because it requires you to compress your creative thoughts in a shorter time span.

"For me, sitting at a computer has become more fun than sitting down at a drafting board. If I'm still working at eight in the evening and I've got a project on the drawing board, I'll probably decide to tackle it the next day. If I'm on the computer, I'll probably finish it. You think of things in a different way. There's a different process. Let's say you're drawing a brick wall. You would first draw all the horizontal lines and then fill in the vertical. On the computer, you have the option of drawing one brick, duplicating it until a section of the wall is complete and then duplicating that section over the entire surface of the wall. Some architects say, 'If I draw faster, I won't have time to think.' That's not how it works."

Metsch cautions that computerization does not bring a "life of leisure" to architects. "We find ourselves making our decisions closer to deadlines," he says. "People are starting a job later but finishing at the same time. We tend to push tight against deadlines. We allow only minutes to revise our computations and estimates because it takes only minutes on the computer. If I was doing project budgets by hand, I'd probably do about two in a half hour. Now I can

do 10 in the same time and those 10 are more finely tuned. You still make the same number of mistakes or correct decisions as always. But with a computer, you can make more mistakes or more correct decisions per unit of time. The computer doesn't change the ratio. It just changes the speed."

"The computer doesn't allow you to go home earlier," says architect James E. Gehman of Hanbury & Company in Norfolk, Virginia. "But it does allow you to do more in the time you do work and it also allows you to analyze more closely what you are doing."

Gehman says weekly updates on his firm's active projects and manpower replace informal seat-of-the-pants projects of precomputer days.

"The update tells us of an increase or decrease in the workload to help us plan marketing, it helps us anticipate our cash flow, it even helps us plan our manpower more accurately by scheduling vacations. It gives us a better grip on the performance of our firm. We're managing our performance better."

"Our basic attitudes toward design are unchanged," says Thompson. "We still want to produce a piece of architecture that is the best we can possibly produce. The computer has not affected our over-all attitude to the final product but it has changed our attitude to the steps that are involved in making judgments that result in the final design. Our biggest problem still is to deliver on time and on budget. And the computer has affected our ability to do that."

**...And onward to expanded
services for picking up slack in
good times and bad**
For those architects already using computers in their operations, the bottom-line claim is that the computer is enabling them to do what they have always done better. And that includes the business of designing as well as the business of running a business. For the majority of the country's architects working in offices of 20 or fewer architects, the business of doing business is as demanding and as time-consuming as the big design work being done.

These typical architectural offices report that the microcomputer enables them to market more effectively and to a greater number of potential customers with higher-quality, more customized mailings; to prepare proposals that are more clearly presented and more thoroughly documented; to submit bids that are more reliably and more precisely plotted out; to draft specifications that are more clear and less subject to error; to prepare

working drawings that are more informative and more flexible; and to plan project schedules that are more accurate and more reliable.

But in some cases, the computer is enabling architects to expand beyond what they have always done into new areas. It is here, in such areas as facilities management, say the smaller firms, where they see the greatest potential for future growth and profits. The architect who carries space inventories for his leasing-agent client (at any one moment, information on what space is available, its condition, its location, its position within a building, its facilities, etc.) says it wasn't a service he had intended to offer but one that simply grew out of the computer capabilities he already had in-house. Another architect who has built up a large reserve of satisfied customers over the years (customers who, he mentions, are not erecting new structures as frequently) provides computerized return-on-investment and energy-consumption analyses for the same building he designed long ago. He sees such services as a way to capitalize on the goodwill and reputation he already enjoys with such clients. It is on developing and providing such new services— services that will be needed year in and year out in the maintenance and operation of buildings—that many architects are concentrating effort for future slow-down and/or increased profits. And in developing these new services, the computer is expected to lead the way.

Karolyn Schuster is a free-lance writer specializing in business subjects and a two-finger typist who estimates that her production has increased by 20 per cent in the year since she traded in her manual typewriter on an IBM PC.
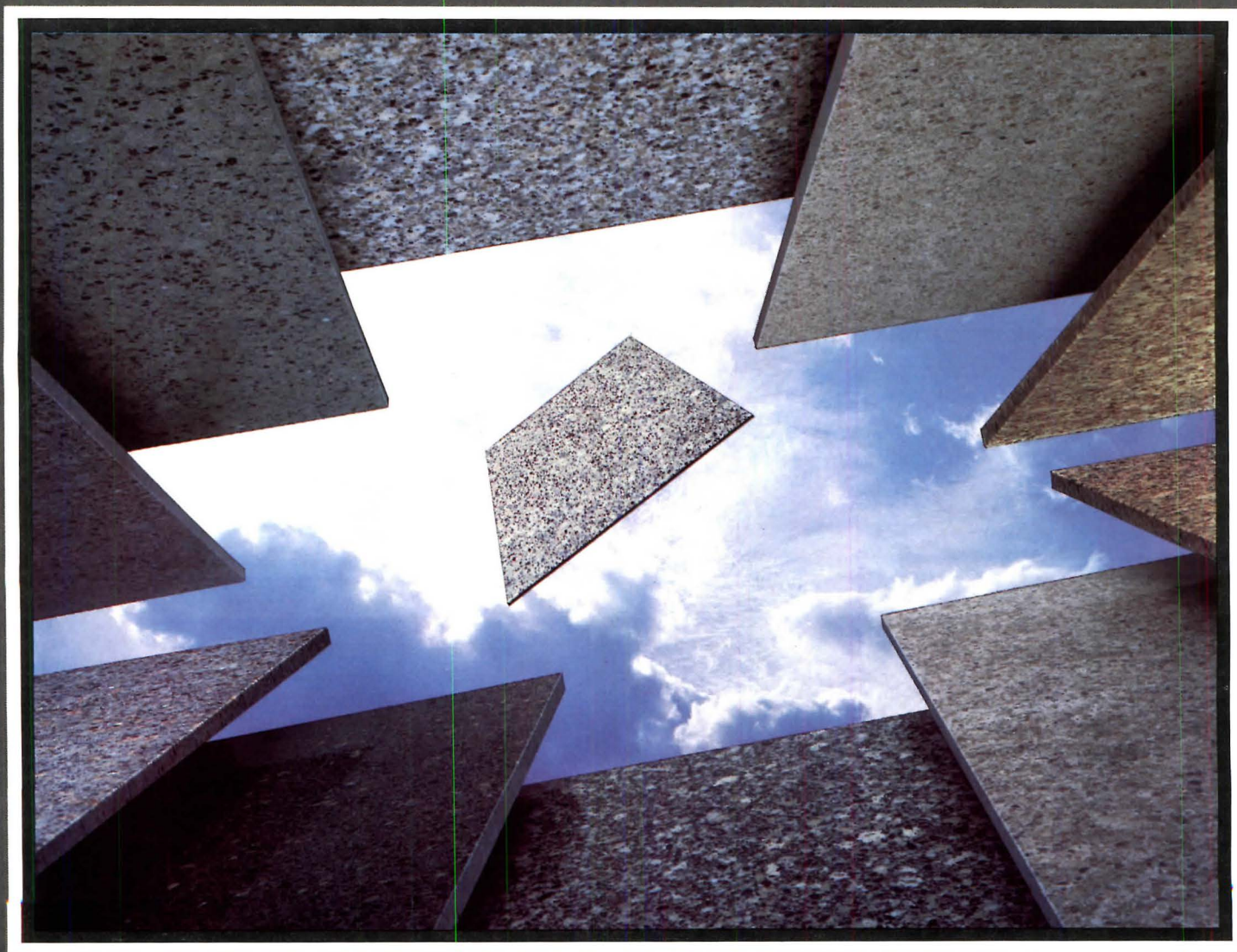
Marketing:
How big corporations choose design firms

*In this concluding part of a series, a survey
reports on interviews by, proposals to and fee
negotiation with corporate clients*

By Martin C. P. McElroy with research by Donna M. McCourt

*In the previous installment of this
series (see RECORD, September
1984, pages 43 through 45) Mr.
McElroy began the description of
how successful design firms
competing for corporate work are
actually selected. He emphasized
the subjective elements, ranging
from "personal chemistry" to
reading into a client's program to
discover what the program may
really be about—describing the
stated program objectives in some
cases as "giving professional firms
enough rope to hang themselves."
At the interview...*

The client's evaluation is not
entirely subjective, or at least, it is
not necessarily a discussion of
approaches and design issues that
seek a responsive chord.

Architects can compound the
problem with descriptions of
organization and staffing, proposed
services, language or exclusions
that are inconsistent with the scope
or nature of the project. As our
later discussion will indicate, a
brilliant presentation can be
undercut by contradictory
boilerplate.

While both chemistry and
understanding the project may be
the basis for the eventual selection
decision, it is important to
understand the procedures that are
used to arrive at these conclusions.

**There is no consistent
pattern for
proposals or interviews**
They occur in any sequence
imaginable and may be so casual as
to seem offhand or so structured as
to be stultifying.

Tours of the architects' offices
and informal meetings are the most
casual form of interview, and are
often preliminary to a more
structured procedure. In two
instances, however, formal
interviews were conducted in the
architects' offices using weighted
checklists for scoring evaluations
and determining the firm to be
chosen. In general, however, it is an
outright litmus test for the chemical
ingredients. Two-thirds of the
companies we talked with tour
candidates' offices regularly. "We
always go to their shops. We look at
specs, drawings, details. You get a
good handle on how busy they are,
their services, size and
sophistication. The brochure may
look great, but there is no
substitute for a first-hand
inspection."

The office tour provides
companies with their best
opportunity to meet members of the
firm who may play a critical role on
the project, but whose presence at a
formal presentation would be
unwieldly in a limited amount of
time. One anecdote revealed the

potentially negative consequences
of the office tour:"We like to meet
department heads and the technical
staff. This firm played it perfectly.
The sales types got out of the way
and we met with four engineers
who were quite good and
knowledgeable. We did detect that
they were not quite experienced
enough with clean rooms, at least
by our standards, though they were
certainly conversant. When they did
not get the job, they accused us of
picking their brains and were quite
chagrined. Actually, we were very
impressed and would like working
with them. The moral is: you can't
always tell when a good interview is
a good interview."

Tours, and their counterpart
informal interviews, are
particularly hard to gauge. Efforts
at hospitality and creating good
impressions can be viewed as
irrelevant or worse, a smokescreen.
The most sensible approach seems
to be to understand beforehand
what the corporate prospect wants
to see, to whom he would like to
speak and have the material and
people available. Tours are not
conducted to view the decor, and no
stronger impression can be made
than that of a skilled professional
presenting competent work. Yes, an
orderly workplace and an
industrious staff win points, but
tours are not for winning projects;
the object is to not lose them here.

**Formal interviews not only win
projects but give a chance to
find out who the client really is**
For the architect who survives to
the point of competitive interviews,
the first question is to find the
client. Depending on the project, the
client will be a mixture of facilities
staff, the user group and corporate
brass, and whose vote counts for
what is an open question. "It gets
complex with people and comments
and corporate concerns beyond this
operation," noted one facilities
head. "A lot of people can get in the
act, and there is no standard for the
amount of interest shown in a
project. Our role is the only
constant." Comments another: "Our
company's user group can be sold
on the first firm interviewed. Our
job is to keep minds open during the
entire process and make sure that
the basics are covered. Then at the
end, we help sort out the facts and
the feelings."

The interviews seem to pretend
an ascending role for the
corporation's project manager in
the interviewing process. Several
firms require that the project
manager make all arrangements
with candidate design firms for
interviews and proposals and direct
the process. "We want the project
managers to have a good feel for
the design people that they will be

dealing with. After all, as goes the
project, goes this manager's
career." In addition to logistical
concerns, the project manager may
be responsible for conveying all
pertinent project information to the
candidate firms and fielding
questions about the scope of work
and the intent of the project.
However shifting the identity of the
"client" may become during
selection, the day-to-day client will
be the project manager.

**While the client's identity may
shift around, the architect's
premise should not**
Regardless of the strategy a firm
may elect to persuade the multi-
faceted client, there is ample
evidence that it pays to find the
point and stick to it. "The last thing
we want to hear is motherhood. So
often we get motherhood. Design
philosophy sounds like so much
boilerplate."

What kinds of points *should* be
made? So many factors were
mentioned in the interviews that it
becomes necessary to interpolate to
find the common denominators. In
the first place, the selection decision
is structured, so far as possible, as
fail-safe: good firms competing for
the work. The interviews with these
facilities people tended to reject the
common wisdom that the designers
should only talk about the client's
project. There is definite interest on
the part of the corporate people in
the designer's past work, and what
the firm did to make its previous
projects successful in hard,
practical terms. *Then,* clients are
interested in how these approaches
will apply to the project at hand.
There seems to be a clear interest in
concrete, tangible attributes at a
time when the client's project may
be vague, even to him; indeed,
especially to him. ("The greatest
ambiguities occur at the beginning
of the project.")

And again, the concerned hands-
on involvement of the senior
members of the firm is sought.
Consultants are another matter.
The majority of these large
corporations look for sole source
responsibility and clear lines of
command. One design firm was
described by a potential client as
"surrounded by so many
consultants, we couldn't find the
firm."

Presentation skills are important,
but less important than a clear
indication of capabilities,
experience, resources and a
reasoned approach to employing
them on the project: "I've been
watching this for years and still
don't understand it. Good firms fall
flat on their faces for poor
presentations. Others can scare you
off with overkill."

In two selection procedures, full design presentations (in one case paid) are required, with stipulated formats covering program, budget, site, massing and design concept. "We see ideas and are able to reach conclusions about the capabilities and resources of the firm." In this light, the issue seems less "what will my building look like" than an earnest attempt to stave off the ambiguity that produces practical anxiety for the client. This haunting uncertainty explains the emphasis on chemistry and understanding the project. It may even explain why corporations increasingly turn to developers for a facilities "product" that can be purchased or leased as a known quantity.

Proposals certainly render the designers' services in black and white
Still, only about half the companies solicit proposals in the selection process. While in some instances the proposal format directly addresses the understanding of the project, staffing and man-hours, even the number of drawings anticipated, more typically it is a brief that indicates the senior professionals to be assigned to the project, the basic scope, services to be provided and the fee, noting exceptions and extras. "They are responding to our format. Some of it we don't worry about because our contract covers us," says one facilities head. "The firm is responding to givens, and a two-page letter only needs to cover exclusions," says another. "The proposal should respond to the schedule and budget, and give assurances as to how they will be met," says a third. "All things being equal, it comes down to fees; things seldom are equal so fees can get me off the hook," says a fourth. Proposals mark the conclusion of the selling phase in which designers have latitude and the start of buying in earnest in which the client is in control. There is a clear indication that there is little to negotiate and that, while fees may vary 10 to 20 per cent, the preferred firm will "conform to our format." This basic outlook is underscored when more elaborate proposals are invited, the visual treatment that can be so persuasive in the public sector is less compelling in the corporate process. "Boilerplate says 'we're gonna do it on our terms'," says one facilities manager. "Sometimes you feel like they took somebody else's name off and slapped ours on," or: "It is downright silly to see a proposal set forth terms contrary to what we've already stipulated, that ignores prior conditions or that gives the resumes of staff that won't be involved in the work."

These comments dramatize the proposal as an instrument of the head and not the heart. It is a time for level-headed summaries of the requirements of the project, the client's conditions and the professional's response to each. If the interview is an opportunity to "sell" the client, then the proposal is the moment when the client buys, and it stands to reason that the proposal be as uncluttered and as conclusive as possible.

By whatever combination of steps the client has chosen to arrive at a selection, the moment is inevitable. An alchemy of personal chemistry, perceived understanding of the project, a reasonable methodology and an acceptable price combine to the advantage of one contender. By letter or phone, the remainder of the field is advised of the "difficult decision," which is true given the even composition of the short list and the efforts of the competitors.

At this point, the successful firm enters into "negotiations" for this project.

More correctly named, the negotiation stage would be called the contract-signing phase
There is little negotiation involved. The proposal has established the fee and the terms are set by AIA B-141, the Standard Agreement Between Architect and Owner. Very few companies have their own form of contract that ranges from one page to multiple volumes. However, B-141 is the standard and most corporate contracts are only variations on its themes.

A contract documents the understanding of two parties, and whatever the limitations of this particular document, we can expect little variation in the future. To run the gamut of approval by corporate legal staffs is a fate that most facilities managers view as dire, at best. Any variations that might stir this pack of "dozing legal beagles" imperils the project's very existence, at least within the current fiscal year.

As a consequence, there is virtually no opportunity for meaningful negotiation. A certain amount of haggling takes place over multipliers, reimbursables or man-hours ("OK, we'll throw in the rendering!"), but the deal is essentially done at the moment of selection. This is perhaps the reason why corporate purchasing departments are involved in only the clear minority of situations. The selection is based on professional standards, the fee has been contained by constraints of competition and the terms are dictated by an industry standard. There is nothing for a purchasing specialist to do.

The signing of the contract,

however, is not necessarily the end of negotiations. While these are demanding clients, they are also eminently fair—fairer perhaps than architects are to themselves.

As one architect, recently designated as project manager for a large, hotly pursued corporate research center, said: "I'm so conditioned to putting out fires that I almost can't comprehend looking at a project in its entirety after the presentation." The actual conduct of work is determined on a day-to-day basis, PERT and CPM networks notwithstanding. This is to say that every decision from how to research the program, to the format for the schematic presentation, to the evaluation of materials or investigation of a specification is a negotiating opportunity, a decision to provide service and effort.

Certainly, every project manager worth his or her salt knows that they have a basic responsibility to claim obvious extras. But unrequired, unnecessary or unexpected services also fall into this category. Many corporate officers took note of a tendency for architects to perform (and design) to self-imposed standards that are more costly and time consuming than necessary to meet the corporations' requirements.

Does this suggest a certain mulishness on the part of the profession? Is it a complacency, forced by the pressures and liabilities of project operations? Is it the failure of clients to demand and create opportunities for a clearer determination of standards and expectations at the start of the work? Is it the absence of a forum to effect these understandings in the absence of a meaningful negotiation phase?

Obviously, it is all of these. When the economy is strong and backlogs are up, there is a rise in the frequency of commentary by architects about their diminished role in the building team. (When things are slow, there is no time for commentary, only competition.)

How will this come to pass? Not from a podium, not in a seminar, nor through the pages of magazines like this one. The stature of the profession simply reflects leadership demonstrated on individual projects. Yet, once the contract is signed, the evidence is that most architects retreat to a standard project approach rather than lead an examination of assumptions and the organization and procedures of the project.

Linguists note that one can be "convinced" of an idea, but is "persuaded" to act
While business development can conclude with persuading an owner to select a firm, the development of

the profession will require further persuasion by the architect's leadership in a rigorous evaluation of the project's opportunities and requirements and engaging every member of the building team in a mutual approach to the project. However convinced architects may be of their leadership prerogatives, they will only be meaningful if others are persuaded to follow.

It has often been said that the client is the most important ingredient in good architecture. It should also be said that good architects create good clients, then go on to create good buildings.

The corporate client may represent the finest opportunity to assert this kind of leadership. The caliber of their management and technical personnel and the suitability of strong management to corporate operations create an exceptional climate to challenge assumptions about how work will be performed once the job has been won. They are a client fully capable of taking the proposal as a point of departure rather than a conclusion. For this to happen, it will take an architect who is confident enough to challenge his own successful proposal and engage the client in searching for a more effective approach.

Mr. McElroy is the head of management consultants Sixty-Eight/52 Associates in New York. He is trained in architecture and communications psychology and has headed the marketing departments for several large design firms.

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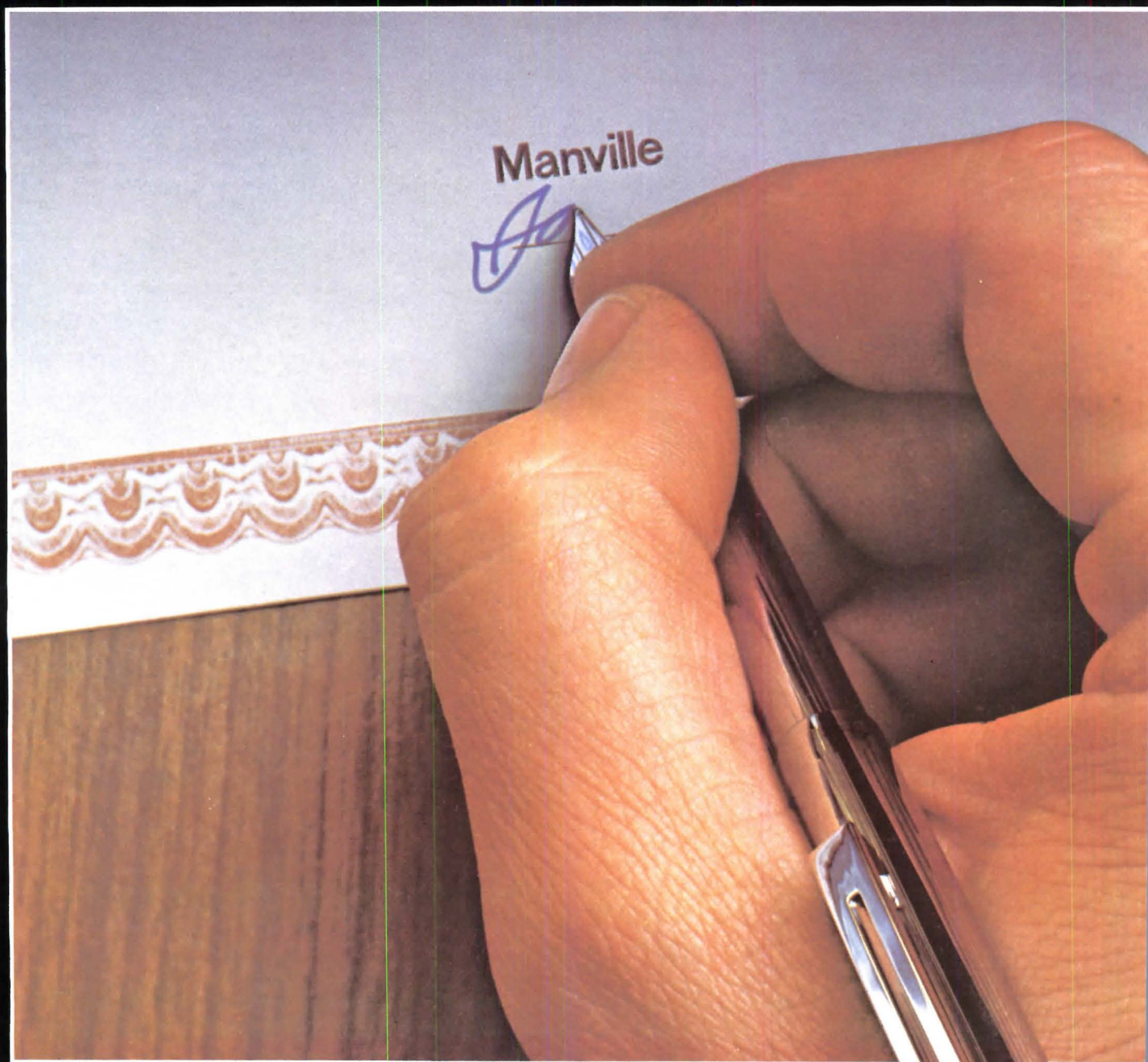
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A guide to computer software for architects and engineers

If there is such a thing as an old saw in the new world of computers, it is this: "The soft spot is software." Nonetheless, as RECORD associate editor Jim Gardner has learned from developing this project over the past ten months, there is a lot of computer software written for architects, and a lot more being written.

On the next 31 pages, you will find listings of over 350 computer software programs written specifically for architects—ranging from simple entry-level programs that run on computer systems costing less than $5,000 to very extensive and sophisticated programs that require major computer installations and are therefore the province of the large and sophisticated firms.

The software programs are listed under six general sections:

Section 1, beginning overleaf under the heading Office Management, lists programs written to aid in business development, simple graphics (such as the production of charts), word processing, production of accounting and other spreadsheets, word processing, specification writing, and database management.

Section 2, Project Cost Analysis and Control, beginning on page 52, includes programs written for project cost accounting and general accounting; job estimating, costing, and budgeting; developing bills of materials and materials take-offs, and making feasibility studies.

Section 3, Project Scheduling and Management, beginning on page 59, has programs developing manpower-utilitization, resource-management, job-scheduling and construction-management systems.

Section 4, on page 63, lists programs for "Space Planning and Facilities Management."

Section 5, beginning on page 64, lists over 100 programs written for "Computer-Aided Design and Drafting." These are graphic systems capable of producing preliminary and/or production drawings.

Section 6, Architectural Engineering, page 75, lists programs for site planning and mapping, energy analyses, hvac design, structural analyses, and related engineering work. Some of these programs produce graphics as well as data.

Some programs, of course, fit tightly into more than one section, and in a few such cases, we repeated the software listing in more than one section. Further, if you have a specific problem that you are interested in automating, you'll find a subject index on the last page of this insert.

A word on the individual program listings: the top line of each listing—in bold type—lists the reader-service number for that program and the program title in alphabetical order. (You can get more information on any program by using the Reader Service card following this insert on page 81-82.) Beneath that you'll find the name and address of the supplier of the software being described, as well as the name and phone number of a person at that company you can call for information. Then you'll find a listing of the hardware required to run that program—since most software is configured to run on a limited number of computers. Listed next is the price—often a one-time license fee which means that you can use the software but don't own it; and sometimes the prices quoted are for software that is "bundled" as part of a turnkey package of software and hardware. The availability and cost (if any) of updates is listed next, followed by the types of training available for each program. Finally, after an italic re-listing of the program name is a brief description of the programs' function(s) and features. We are of course not qualified to evaluate the software, and have not attempted to do so. Rather, the descriptions are intended to let you see what functions can be "computerized" for work in the office both non-graphic and graphic.

RECORD made a major effort over several months to locate sources of architect-specific software—by contacting architects large and small and known vendors of software as well as computer manufacturers, and by inviting submissions in our own pages and in our sister McGraw-Hill magazine, BYTE. Everyone we could locate was sent a questionnaire which formed the basis of this 32-page listing. Hundreds of follow-up telephone calls were made to check information supplied. But we were not able to publish a listing for every supplier that returned a questionnaire, and of course we undoubtedly missed many useful sources. If you sell or if you know of architect-specific software not listed in this directory, please let us know by writing James B. Gardner, ARCHITECTURAL RECORD, 1221 Avenue of the Americas, New York City, and we will send you a questionnaire. We plan to supplement this directory by listing such software on a continuing basis.

Business development
Database management
Simple graphics
Specification writing
Spread sheets
Word processing

500 ARCHITECT'S DB MASTER TEMPLATES

Top-Ten Software, P. O. Box 6436, New York, N. Y. 10128—Lee Kennedy, RIBA, 212-188-6656 • For use with Apple II with Applesoft and DB Master; requires 48k RAM • Price: $19.95 each; $49.95 for all three; add $2.50 handling. Updates: none planned • Training: instructions.

Architect's DB Master Templates is a series of three templates designed to run with DB Master. Space Programming handles numbers-tracking and projections, and enables a user to create a space program and to generate various user-defined reports. Furniture Inventory tracks client's current and proposed furniture, its whereabouts, and cost. Client Marketing Directory is a database that maintains full information on a client-base, including current projects, personal data, competition, etc.

501 ARCHITECT'S FRIEND—V1.1

Team Design, 5290 North Picket Dr., Colorado Springs, Colo. 80907—Bob Moore, 303-598-0663 • Program operates as part of a turnkey system or with IBM PC and compatible computers running MS-DOS. Peripherals include PGS MAX-12 and Color Graphics XL-19 monitors; Houston Instruments DMP-52 plotter; SAC Sonic digitizer and NEC P-3 printer • Price: from $2,895 for software; $27,995 for turnkey package; Updates: free; modem option • Training: in-house, on-site, manual, computer-aided instruction and video-training cassettes.

Architect's Friend—V1.1 is an integrated graphics-based applications package that includes project management, energy analysis, full accounting, floor plans, elevations, renderings and development planning. Written in "C" language for transportability. Uses a standard file management database.

502 ARCHITECTURAL SPECIFICATION GENERATION PACKAGE

Intergraph Corporation, One Madison Industrial Park, Huntsville, Ala. 35807—Al Kemper, 205-772-2000 • A basic turnkey system consists of one computer workstation, hard printer, plotter and software. Systems are based on DEC-VAX and PDP-11 computers • Price: $5,000; Updates: free with service/maintenance contract or billable • Training: in-house, on-site implementation plan, computer-aided instruction and manual.

Architectural Specification Generation Package helps an architect define, compile and output a specification manual for a project.

503 CALC MASTER

Hourglass Systems, P. O. Box 863, Brookfield, Wisc. 53005—Jim Beirs, 414-781-6815 • For use with Wang models VS/MVP/LVP/SVP and VP • Price: from $495; Updates: billable •Training: manual and computer-aided instruction.

Calc Master is a spreadsheet with windows, consolidation, lookup, move commands as well as full financial (IRR, NPV, FV, depreciation) and log and trig functions. Editing commands include insert, delete and global functions. Among formatting capabilities are dollar sign, per cent, underlining, repeat, center, justify, cell blanking, cell skip/lock, calculation-order control, comma and decimals.

504 CLIENTRAC

Technical Information Systems, Inc., 116 West Plume St., P. O. Box 1900, Norfolk, Va. 23501—Eugene D. Thayer, P. E., 800-368-4203 • For use with DEC-VAX or PDP-11 • Price: $4,000 for VAX, $2,500 for PDP-11; Updates: free for first ninety days; included with maintenance contract thereafter • Training: on-site, in-house, manual and computer-aided instruction.

Clientrac uses a database containing historical data on the firm, its clients, prospective clients and past projects and proposals to generate new proposals, summaries, project examples, resumes, analyses, mailing lists, newsletters and other reports useful for producing marketing and business plans. Program was developed by the marketing director of a 100-man engineering firm.

505 CONDOR 3

Condor, 3290 West Bayshore Rd., Palo Alto, Calif. 94303—Richard Aure, 415-424-8311 • For use with computers running the following operating systems: CP/M, MP/M, CDOS, TURBODOS, MS-DOS, CP/M-86, PC-DOS or Xenix; requires a CRT and line or character printer • Price: $650; Updates: billable • Training: seminars, in-house, on-site, manual and tutorial manual.

Condor 3 is a file management, inquiry and report-generating data management software system for storing, retreiving, manipulating and comparing data. Database files

may be added or reorganized. Sorts may be conducted on several levels. Applications include marketing, accounting and inventory lists.

506 CONSTRUCTION MARKETER

Tecton Media, Inc., 350 Madison Ave., New York, N. Y. 10017—Ken Smith, 212-867-0820 • For use with IBM PC, PC-XT or compatible microcomputers with 128k RAM; requires two double-sided, double-density disk drives • Price: $395; Updates: billable • Training: manual.

Construction Marketer is a database management and reporting software system designed to improve a firm's efficiency in tracking prospects, projects, clients and sales contacts. Reports include forecast, follow-up and win/loss—all sortable on any of 47 fields. System available on a 30-day trial.

507 DISCO-SPECS

Disco-Tech/Morton Technologies, 600 B St., P. O. Box 1659, Santa Rosa, Calif. 95402—Ralph R. Russe, P. E., 707-523-1600 • Runs on all CP/M-80, CP/M-86, MS-DOS or TRS-DOS compatible hardware • Price: $195; Updates: billable • Training: manual.

Disco-Specs is an architectural specification-writing data package compatible with Spellbinder, WordStar, Perfect Writer, Scripsit and Super Scripsit word processing programs (not included). The program database is a set of specifications in each of the 16 CSI divisions which the user modifies to produce the final operating specifications.

508 ENHANCED BUSINESS GRAPHICS

Strobe, Inc., 897 5-A Independence Ave., Mountain View, Calif. 94043—Elizabeth D. Holthofer, 415-969-5130 • For use with Apple II/IIe/III and microcomputers running CP/M, PC-DOS and MS-DOS • Price: $195; Updates: billable • Training: manual and computer-aided instruction.

Enhanced Business Graphics allows the user to produce a broad range of line graphs, bar graphs, pie charts and word charts or overhead transparency film. Bar graphs may be stacked or side-by-side. Pie chart slices are automatically calculated when amounts are given. Formatting is directed through menu-driven commands.

509 GEOGRAF

Geocomp Corp., 342 Sudbury Rd., Concord, Mass. 01742—W. Allen

Marr, 617-369-8304 • For use with IBM PC, PC-XT, PCJr. and compatibles; requires graphics card, screen and pen plotter • Price: $250; Updates: billable • Training: manual.

Geograf is a programmer's utility that condenses routine programming commands into sub-routines, simplifying the creation of graphics on a screen or plotter.

510 HOK CHART

Hellmuth, Obata & Kassabaum, Inc., 100 North Broadway, St. Louis, Mo. 63102—Daniel C. Davis, 314-421-2000 • For use with any DEC-VAX computer using Tektronix display devices • Price: varies depending on application; Updates: included with service/*maintenance contract* • Training: seminar, in-house, on-site and manual.

HOK Chart is used to define and display various types of graphs, including pie charts, bar charts, line graphs, organizational charts and schedules. The graphs may be displayed individually or in combination at any size. Data may be input directly using a command language or extracted from a database or spreadsheet. The system also allows for creation of HOK-standard text slides. The graphs may be displayed interactively, plotted in hard copy form, or transferred directly to 35mm format.

511 IB GRAPH

Data Processing Design, Inc., 1400 N. Brasher, Anaheim, Calif. 92807—Chuck Sargent, 714-970-1515 • For use with DEC-VAX 11/725, 11/730,11/750, 11/780 and PDP-11 systems • Price: from $5,500 depending on hardware; Updates: included with annual support • Training: in-house, on-site and manual.

IB Graph is a menu-driven graphics software package for creating bar, line and pie charts on a variety of graphics output devices. Program modules include main menu, data group editor, chart specifications editor, plot, utility and data translation.

512 INFOGRAF

Graphic Concepts, Inc., 6797 N. High St., Worthington, Ohio 43085—Roger L. Routson, 614-885-2416 • For use with Prime, Harris and VAX computers; requires 500k RAM; capable of driving over 100 graphics devices • Price: $9,800;

Updates: billable • Training: manual and computer-aided instruction.

Infograf is a command-driven business graphics package for creating two- and three-dimensional bar, line, pie, Gantt, stop, scatter and range charts. User can create free-form graphics as well. Utilizes intelligent defaults, prompting and help messages.

513 INTERPAGE

Intergraph Corporation, One Madison Industrial Park, Huntsville, Ala. 35807—Al Kemper, 205-772-2000 • A basic turnkey system consisting of one computer workstation, hard printer, plotter and software. Systems are based on DEC-VAX and PDP-11 computers •Price: Turnkey package with software starts at $120,000; Updates: free with service/maintenance contract or billable • Training: in-house, on-site implementation plan; computer-aided instruction and manual.

Interpage is a technical publications program that produces specification manuals, operational manuals, proposals, and marketing brochures. It merges text and drawings on a workstation screen so that composed pages can be previewed before output to a typesetter or laser printer/plotter.

514 KEYSTONE WORD PROCESSING

Keystone Project Management Systems, 235 S. Maitland Ave., Maitland, Fla. 32751—Stan Levine, 305-628-1832 • For use with computers running CP/M, CP/M-86, MS-DOS and PC-DOS (includes computers from Texas Instruments, Digital Equipment Corporation, IBM and Wang); CP/M requires 53k RAM, 128k for all others; turnkey hardware package provides 46mb of disk storage • Price: $4,500—$6,000 for software; Updates: billable •Training: seminar, in-house, on-site and computer-aided instruction.

Keystone Word Processing is part of the Keystone Project Management System. Produces reports memos, letters and specifications. Features help menus, special keys, bookmark, scrolling, on-screen formatting, disk storage, up to 250 columns of text, proportional printing and file merging. Stand-alone or multiple-user system with networking and database capability. Other modules are general ledger, and CADD (see other sections).

515 MASTERSPEC

The AIA Service Corporation, 1735 New York Ave., N. W., Washington, D.C. 20006—Leonard Bain, 1-800-424-5080 • Diskettes are available for almost all types of computer equipment • Price: yearly subscription fees vary from $420 to $575 depending upon version selected; Updates: issued quarterly as part of basic subscription •Training: manual.

Masterspec is an automated database master specification system compatible with hundreds of computer systems. The program employs the 16-division format of the Uniform Construction Index and the five digit numbering system developed by The Construction Specifications Institute. It is claimed that the system can cut specifying time in half. Editions are Architectural/Structural/Civil and Mechanical/Electrical. Each is available in "Basic," "Short" and "Narrow" scope versions.

516 MITAS

MIICORP, Box 17130, Dulles, Washington, D. C. 20041-0130—Rob Mainor, 703-471-1717 • For use with IBM System 34, System 36 and IBM PC-XT or compatible microcomputers; requires 128k RAM • Price: $9,500 for System 34 and 36; $3,500 for PC-XT; Lease/purchase plans available for 1, 2, or 3 years; Updates: free first year, 10 per cent of program cost thereafter •Training: on-site, manual.

Mitas aids firms in developing new and current business as well as analyzing resources. Features individual-influence network and client-base analysis, a lead and prospect capture system, marketing summaries, and resource requirements.

517 NOVACALC

Hourglass Systems, P. O. Box 863, Brookfield, Wisc. 53005—Jim Beirs, 414-781-6815 • For use with IBM PC or CP/M-based computers having two disk drives and 64k RAM • Price: $29.95; Updates: none required •Training: manual and computer-aided instruction.

Novacalc is a low-cost spreadsheet that includes full financial and scientific functions such as depreciation, IRR, NPV, Logs and Trig. Other features are variable column widths, decimal and comma formatting, on-screen help and flexible printing. CP/M versions have wide- carriage printing and full spreadsheet consolidation.

518 PAGS—PERRELL ARCHITECTURAL GUIDE SPECIFICATION

Perrell-Andros Consulting Architects, 4260 N. Brown Ave., Suite A, Scottsdale, Ariz. 85251—Richard C. Perrell, 602-946-0555 • For use with Digital DECMATE, DECMATE II or Rainbow • Price: $2,500; Updates: free for first three years (quarterly disk-swap) • Training: on-site and manual.

Pags—Perrell Architectural Guide Specification is a "drop-out" type specification system, with 168 technical sections in 16 divisions, that is oriented towards materials and systems available specifically in the Southwest. The program, written by a registered architect, is currently in use by over 30 Southwestern firms.

519 PROFESSIONAL ACCOUNTING SYSTEM

Heiniger Associates, 636 Jefferson St., Morton, Ill. 61550—Jim Heiniger, 309-266-5812 • For use with Wang 2200 System (SVP/LVP/MVP); requires 64k RAM • Price: From $1,500, depending on number of modules purchased; Updates: billable • Training: manual and on-site.

Professional Accounting System integrates job-costing/marketing software, including payroll, general ledger, accounts payable and word processing. Generates multiple invoice formats. Other modules are projects (Form 254, 255), contact information, personnel/company information, calendars and labels. See listing under 602 for further information.

520 RECORD BANK

S&R Cerati, Architects, Piazza Europa 26, Cuneo, Italy 12100—Rudolfo Cerati, 66 291 • For use with: IBM PC and compatibles • Price: $125; Updates: billable • Training: manual.

Record Bank is a database management system with a variety of filing and reporting capabilities including connection of main and secondary data files on a one-to-many-relationships basis. The program provides consistent prompting, full use of keyboard function keys, on/off help menus and programmable, formatted outputs. It is designed to run with *Estimate* (see 579) to produce detailed construction cost estimates and analyses.

521 RL-1 RELATIONAL DATABASE MANAGEMENT SYSTEM

ABW Corporation, P. O. Box M1047, Ann Arbor, Mich. 48106—Jill L. King, 313-663-3011 • For use with IBM PC, PC-XT, PCJr., IBM PC compatibles, Wang PC and Victor 9000; requires 128k RAM • Price: $495; Updates: billable • Training: manual.

RL-1 Relational Database Management System is an integrated system for data storage and retrieval. Data is entered into various tables that appear on the screen. Retrieval is through interactive query language that consists of 13 key words. All types of data relationships can be handled including one-to-one, one-to-many, and many-to-many.

522 RSI BASIC

Rising Star Industries, 24050 Madison St., Suite 113, Torrance, Calif. 90505—Mark Jones or David Schmidt, 213-373-4421 • For use with Epson QX-10 • Price: $100; Updates: nominal charge • Training: manual.

RSI Basic is a graphics-oriented version of Basic programming that permits users to create, edit, store and/or transfer drawings to a dot-matrix printer or plotter. Supports X-Y graphics such as line, circle, arc, rectangle and pattern-fill.

523 RTFILE

Contel Information Systems, 4330 East West Highway, Suite 200, Bethesda, Md. 20814—Judith C. Mangels, 301-654-9120 • For use with DEC-VAX, PDP-11, LSI-11 and PRO-350; requires 64k RAM • Price: $1,500 to $8,500 depending on operating system; Updates: billable • Training: computer-aided instruction.

Rtfile is an interactive, relational data-base management system that enables users to create and modify files, screens and reports and to sort modules without the need for programming experience.

524 SPEC-WRITER

ACCI Business Systems, Inc., 4625 N. Freeway, Suite 200, Houston, Texas 77022—Paul Pamer 713-697-3566 • For use with IBM PC, Compaq, TeleVideo, Vector or other microcomputers running CP/M or MS-DOS; must have WordStar or Memorite word processing; requires 64k RAM • Price: $750; Updates: billable • Training: manual.

Spec-Writer works with a text editor to aid in the preparation of camera-ready specifications. Automatically renumbers and re-alphabetizes modified specifications. Puts Masterspec II files into the CSI format.

525 SPECTEXT-ON-MAGNETIC MEDIA

Bowne Information Systems, 400 Oser Ave., Hauppauge, N. Y. 11788—Robert A. Cohn, 516-231-

0333 • For use with 8-in. or 5 1/4-in. diskettes for more than 100 different microcomputers • Price: $1,100-$2,400 subscription fee, depending on number of CSI divisions purchased; Updates: first year free, then billable at $300 to $750 per year, depending on number of CSI divisions purchased • Training: none needed.

Spectext is a master guide specification written by specification consultants and reviewed and recommended by CSI. May be used for the development of a comprehensive master specification tailored to the specific practice of a firm, or for inserting sections directly into a project specification under development.

526 SPOTLIGHT
Software Arts, 27 Mica Lane, Wellesley, Mass. 02181—Diane Marsili, 617-237-4000—For use with IBM PC, PC-XT or Compaq Portable Computer; requires DOS 2.0 and 64k RAM memory • Price: $149; Updates: free or billable, depending on type.

Spotlight is an on-screen organizer with accessories that can be used alone or with nearly every software program currently available for the IBM PC, PC-XT and Compaq computers. Provides a flexible appointment book with optional reminder "alarm clock," on-screen calculator, telephone and address book, index card file for organizing notes, note pad for writing messages, and a DOS filer for using the operating system while still in another program.

527 STROBEVIEW
Strobe, Inc., 897 5-A Independence Ave., Mountain View, Calif. 94043—Elizabeth D. Holthofer, 415-969-5130 • For use with Apple II/IIe/III and microcomputers running CP/M, PC-DOS and MS-DOS • Price: $75; Updates: billable • Training: manual and computer-aided instruction.

Strobeview assists in the generation of hard copy and overhead transparencies for presentations or outlines for reports. The program formats text and permits selection of different text styles. Pre-digitized shapes and other aids are included to create simple text/shape charts, presentation charts with emphasis bullets and multi-level organizational charts.

528 TK!SOLVER
Software Arts, Inc., 27 Mica Lane, Wellesley, Mass. 02181—Diane Marsili, 617-237-4000 • For use with IBM PC, Wang PC, DEC Prof. 350, DEC Rainbow 100, Apple IIe, TI Prof. Grid Computer, Canon AS-100,

Eagle 1600, Toshiba T300, Zenith Z-100; requires 128k-256k RAM • Price: $399; Updates: billable • Training: phone, tutorial, seminars, manual.

TK!Solver is an interactive personal computer program that processes equations to solve business, science, engineering, and educational problems without programming. Solves for any variable in an equation. Optional TK!SolverPack ($100) solves equations commonly used in the planning and estimating stages of construction, including solar heating, stress analysis and cost estimating.

529 VISICALC PACKAGE
Software Arts, 27 Mica Lane, Wellesley, Mass. 02181—Diane Marsili, 617-237-4000 • For use with Apple IIc or II+ running DOS 3.3 or PRODOS; VisiCalc advanced version requires Apple IIe or IIc running DOS 3.3 or ProDOS • Price: $179; Updates: free or billable depending on upgrade.

VisiCalc Package provides two enhanced versions of perhaps the best-known spreadsheet for users of Apple II personal computers: VisiCalc for single disk-drive machines, and VisiCalc Advanced Version (requiring two drives). Both offer full work prompts, variable column widths and 40/80 column display support.

530 WORD IMAGE PROCESSING SYSTEM
Datacopy Corp., 1215 Terra Bella Ave., Mountain View, Calif. 94043—Sue Seubert, 415-965-7900 • For use with IBM PC-XT; requires 640k RAM • Price: $9,945; Updates: billable • Training: manual.

Word Image Processing System permits images (people, graphics, things) recorded with a digitizing camera to be integrated into the output of most IBM PC-XT-compatible communications, graphics, database-management, spreadsheet and word-processing software. Images can be edited and scaled before they are printed.

531 WORD-11
Data Processing Design, Inc., 1400 N. Brasher, Anaheim, Calif. 92807—Chuck Sargent, 714-970-1515 • For use with DEC PRO-350, VAX and PDP-11 • Price: $595-$9,500 depending on hardware; Updates: included with annual support • Training: on-site, in-house and manual.

Word-11 is a word-processing program that includes list processing, spelling-error detection, footnoting, automatic table of contents, and enhanced editing capabilities.

537 ACCOUNTING FOR DESIGN PROFESSIONALS
Yeakel Electronic Software, Inc., 185 El Camino Real, Tustin, Calif. 92680—Fred Yeakel, 714-832-9371 • For use with IBM System 34, 36, 38 or PC-XT • Price: $5,000 (includes source code); Updates: billable—at $85 per month includes hotline • Training: in-house, on-site, manual and computer-aided instruction.

Accounting for Design Professionals is a multiple-user on-line project and employee control system enabling all invoicing and accounting functions to be accomplished with a single entry of the source document, time cards or accounts payable. Program is menu-driven and can work with an IBM query program to create database capability.

538 ACCOUNTING FOR ENGINEERS AND ARCHITECTS (AEA-1)
Global Computer Systems, Inc., 48200 Garfield Rd., Mt. Clemens, Mich. 48044—Anousha Shifteh, 313-286-1321 • For use with any Wang 2200 series mini-computer; requires 32k RAM and 5mb disk storage • Price: $7,000-$12,000; Updates: free • Training: seminar, in-house and manual.

Accounting for Engineers and Architects is a fully integrated menu-driven job-cost accounting system for small- to medium-sized A/E firms. Contains six modules: payroll and personnel, project-cost accounting, accounts payable, accounts receivable, general ledger and financial statements and utilities. Tracks project cost by classification and labor function and provides a detailed audit trail and accounting flow-through.

539 ACE
Business Information Systems, Inc., 747 Third Ave., New York, N. Y. 10017—Julie Farrell, 212-752-0831 • For use with IBM PC or PC-XT (running PC-DOS, CP/M-86 or RM/COS); requires 64k RAM and hard disk • Price: $2,500—$6,995 (base module through complete system); Updates: some free, some billable • Training: seminar, in-house, on-site, manual and computer-aided instruction.

ACE is a full-scale, integrated accounting and management system, following AIA specifications, that comprises ten subsystems: project, employee, time-record processing, billing, accounts receivable, accounts payable, engineers payable, general ledger (cash and accrual), management and utilities. Each module functions independently at the user level and can be enhanced by the user.

540 A/E MULTIPURPOSE
Pietro Cassinadri, 704 S. 10th St., Richmond, Ind. 47374—Pietro Cassinadri, 317-962-8842 • For use with IBM PC, two disk drives, 256k RAM; monochrome monitor and dot matrix or daisy printer • Price: $160; Updates; billable • Training: manual.

A/E Multipurpose is a package containing a variety of programs developed for the design-build firm. Includes: conceptual estimates, project cost analysis and cost control, critical path analysis, structural analyses (shear-bending-deflection-beams-columns-shells-trusses-retaining walls-wood-steel-concrete-composite materials), E. T. (heating/cooling loads-solar system analysis with consideration to future cost of fuels, lighting and PVC-acoustical analysis), financial equations and letter writing.

541 AE/DB BASIC SYSTEMS
Halford A/E Systems Corporation, 5207 McKinney Ave., Dallas, Texas 75205 • For use with micro-computers running CP/M-80 or 86, MP/M-80 or 86, PC-DOS or TURBOSDOS; requires hard disk and 48k RAM for 8-bit machines; 96k for 16-bit machines • Price: $2,000 to $5,000 depending on firm size and software configuration • Updates: billable; Training: on-site, telephone consultation and manual.

AE/DB Basic Systems is a modular, integrated general accounting, project-cost accounting and database management system for general accounting, ledger and journals, project-cost accounting, basic financial reports, key indicator reports, simplified accounts payable and receivable, client and project list maintenance and basic employee records.

542 AEGIS
Software Inc., 10014 North Dale Mabry, Suite 101, Tampa, Fla. 33618—Anita Karst, 813-963-2127 • For use with any Prime, Data General or DEC computer; supports a wide variety of graphics terminals • Price: $12,500—$19,000 depending on size of system; Updates: free • Training: on-site and manual.

Aegis collects employee, project and financial data and generates appropriate financial and project records and required reporting. Produces client invoicing and vendor payments. Menu-driven or

Bills of materials
Feasibility studies
Job budgeting
Job costing
Job estimating
Materials take-offs
Project cost accounting

direct-command-entry format. Permits employee time-reporting to be recorded off-line at a remote terminal.

543 AEPEX

Timberline Systems, Inc. 7180 S. W. Fir Loop, Portland, Ore. 97223—Judy Gazley, 503-684-3660 • For use with IBM PC-XT, TI PC, DEC Rainbow and Sage II/IV • Price: $4,900; Updates: billable • Training: seminars, manual.

Aepex is a project management and accounting system for small- to medium-sized firms, which permits flexible numbering of project tasks and the reporting, billing and invoicing of projects. Users can number jobs in any format, produce a variety of project reports and select from 99 invoice styles.

544 ANALYSIS

Haulman Associates, 9886 E. Belmont, Sanger, Calif., 93657—Donald J. Haulman, AIA, 209-251-0823 • For use with TRS-80 Models 1, 3 and 4, disk and printer; requires 48k RAM • Price: $295; Updates: billable • Training: manual and computer-aided instruction.

Analysis plans tasks and profit for architectural and engineering projects. Establishes project budget and determines labor dollars available or necessary for successful completion. Follows AIA-recommended procedures. Works value-based or cost-based pricing strategies. On-screen and printout of data.

545 ANAREAL

The Anareal Corporation, 3310 West End Ave., Nashville, Tenn. 37203—Richard Fletcher, 615-383-8325 • Timesharing software accessed via various makes of microcomputers and CRT terminals; requires a 1200-baud modem • Price: $57 per analysis; Updates: free • Training: manual and computer-aided instruction.

Anareal enables an architect to determine whether to commit time and effort to speculative work. Program provides for complete source and application of funds, projected for the construction period, rent-up period and 10 years of stabilized operation.

546 ARCHITECT'S BUSINESS MANAGER

Architectural Computer Software, P. O. Box 48ll, Santa Barbara, Calif. 93103—John W. Watson, 805-962-4962 • For use with Apple IIe/III and IBM PC and PC-XT • Price: $2,000—$2,500; Updates: $150 per year • Training: seminar, in-house and manual.

Architect's Business Manager is an integrated financial management system designed for small- to medium-sized architectural and engineering firms. Maintains job-expense, billing and accounts receivable information about each project. Produces standard or custom reports for job costs, client billing, cash flow, income, balance sheets and more. Standard modules are job-cost, payroll, accounts payable and general ledger.

547 ARCHITECT'S BUSINESS MANAGER

Concept Group, Inc., 4849 North Mesa, Suite 101, El Paso, Texas 79912—Andrew Dorris, 915-544-4444 • For use with Apple II+/IIe/III, Apple II/Corvus (DOS 3.3), IBM PC-XT and Compaq; requires two floppy disk drives and a 10mb hard disk • Price:$2,000—$3,200, depending upon hardware; Updates: nominal charge • Training: manual.

Architect's Business Manager is a job-cost and general accounting system for firms of up to 250 employees with up to 225 active jobs. The chart of accounts and accounting procedures follows the AIA recommendations, yet can be modified to suit a firm's individual needs. Job-cost, payroll, general ledger and accounts payable are the interactive program modules.

548 ARCHITECT'S FRIEND—V1.1

Team Design, 5290 North Picket Dr., Colorado Springs, Colo. 80907—Bob Moore, 303-598-0663 • Program operates as part of a turnkey system or with IBM PC and compatible computers running MS-DOS. Peripherals include PGS MAX-12 and Color Graphics XL-19 monitors, Houston Instruments DMP-52 plotter, SAC Sonic digitizer and NEC P-3 printer • Price: from $2,895 for software, $27,995 for turnkey package; Updates: free; modem option • Training: in-house, on-site, manual, computer-aided instruction and video-training cassettes.

Architect's Friend—V1.1 is an integrated graphics-based applications package that includes project management, energy analysis, full accounting, floor plans, elevations, renderings and development planning. The program is written in "C" language for transportability and uses a standard file management database.

549 ARCHITECT'S OFFICE MANAGER

The Pyros Partnership, AIA, 1327 Baker St., Costa Mesa, Calif. 92626—Gregory Pyros, AIA, 714-545-1264 • For use with Apple II/IIe/IIc/III, IBM PC and TI microcomputers • Price: $495; Updates: free for first six months, billable thereafter • Training: manual and computer-aided instruction.

Architect's Office Manager, written by an architectural firm for itself, automates job-cost reporting. Figures profits, markups, billings and reimbursables. Uses AIA- or user-defined formats for cost accounting. Permits variable billing rates. Reports show every job by phase, hours/dollars-budgeted/spent, totals-to-date and percent complete.

550 ARCHITECT'S VISI-TEMPLATES

Top-Ten Software, P. O. Box 6436, New York, N. Y. 10128—Lee Kennedy, RIBA, 212-288-6656 • For use with Apple II with Applesoft and 48k RAM • Price: $19.95; $49.95 for all four; add $2.50 for handling and 8.25 per cent sales tax if New York resident; Updates: none planned • Training: instructions/samples.

Architect's Visi-Templates is a series of templates designed to run with Visicalc. Project Budgeting estimates a construction budget. Project Management generates fees, sets profit margin, and allowable for each phase of work. Also tracks performance against budget and profitability versus performance. Space Programming presents a simplified format for interactive program generation. The Accounting templates, for the small office, are general journal and an expense and bank reconciliation ledger.

551 ARCHITECTS ACCOUNTING PROGRAM

Computer Services, P. O. Box 702, Atkinson Mill Rd., Fairmont, N. C. 28340—James C. Atkinson, 919-628-8727 • For use with TRS-80 models 1, 3, 4, 12 and 16; requires 48k RAM and 250k disk storage • Price: $100; Licensed to end user only when purchased or leased; Updates: none • Training: manual and computer-aided instruction.

Architects Accounting Program is designed for the small architectural firm, yet permits any number of accounts. The program tracks expenses and income by project and works as a double-entry bookkeeping system: user makes one entry for each transaction, similar to a check register, program posts entry to all other records automatically.

552 ARCHITECTURAL/ENGINEERING MASTER ACCOUNTING SYSTEM

Data-Basics, Inc., 11000 Cedar Rd., Suite 110, Cleveland, Ohio 44106—Jeffrey Kilb, 216-721-3400 • For use with Wang VS, Wang 2200, Wang PC, IBM PC, Victor 9000, DEC Rainbow 1002, Compaq and Corona; requires 128k RAM • Price: $4,890; Updates: billable • Training: on-site, manual and computer-aided instruction.

Architectural/Engineering Master Accounting System is an integrated job-costing, payroll and accounting system with single-entry posting to all related accounts. Tracks all costs through the life of a project. Reports available in summary or detail. Modules available are job-costing, payroll, accounts receivable, accounts payable, general ledger and automatic invoicing.

553 ARTEC III

Go Fukai, P. O. Box 330040, San Francisco, Calif. 94133—Dennis Fukai, 415-824-3093 • For use with Macintosh and Lisa with optical or laser printer; requires 512k RAM and a 5mb hard disk • Price: $1,300/yr. on license; Updates: billable • Training: on-site and computer-aided instruction.

Artec III categorizes material and cost data established in "keyroom" references developed by Artec II. Construction management and cost information are updated as design and/or specification changes are finalized. Output is interfaced with graphic references and is intended to provide continuous construction support via on-site computer hardware.

554 ASSISTANT MANAGER

EMA Management Associates, Inc., 1145 Gaskins Rd., Richmond, Va. 23233—Terri C. Connell, 804-740-8332 • For use with TRS-80 Models 2, 3, 4, 12, 16, two disks, 48k RAM and an 80-character or larger printer • Price: $195— $245, depending on computer model; Updates: free • Training: manual and computer-aided instruction.

Assistant Manager supports up to 230 accounts with user-defined titles and monthly/annual or running

total budgets, then tracks and compares expenditures with total budget, reporting per cent spent and actual dollars remaining for each account. Reports printed for any combination of accounts and postings.

555 AUTOMATED COST ACCOUNTING SYSTEM
NOW Computer Systems, Inc., 8840 Tradeway, San Antonio, Texas 78217—Nathan O. Wehe, 512-821-6922 • For use with IBM PC-XT; System 34 and 36 • Price: $3,000—$18,500; Updates: billable • Training: seminar, on-site and manual.

Automated Cost Accounting System provides interactive or stand-alone automated general accounting, cost analysis, job-cost control, estimating and job scheduling. The software is modular and designed to run in either small- or large-firm environments.

556 BASIL
Tradefix Co., P. O. Box 273, Church St. Station, New York, N. Y. 10008—Dr. Basil Venitis, 718-639-5503 • For use with IBM PC, two disk drives, one printer • Price: $5,000; Updates: payable in advance • Training: seminar and in-house.

Basil is a financial model used by architects to predict interest rate fluctuations. Can also be used to predict prices for any sort of commodities and investments.

557 BMP: BILL OF MATERIALS PLUS
C. R. Smolin, Inc., 5230 Carroll Canyon Rd., Suite 206, San Diego, Calif. 92121—C. R. Smolin, 619-455-1285 • For use with any microcomputer running CP/M-80, CP/M-86 or MS-DOS; requires 132-column printer; hard disk recommended • Price: $995; Updates: free • Training: manual.

BMP: Bill of Materials Plus is a complete bill of materials processor and engineering documentation control system that supports a multiple database of up to 32,000 parts per database and includes extensive costing and cost roll-up features. Reports, which have comprehensive sort and data selection capabilities, include part master, single level, indented and summary bills-of-material, "where used," and manufacturer's cross reference.

558 CAMS
Construction Systems Associates, Inc., 2121 Newmarket Pkwy., Suite 124, Marietta, Ga. 30067—James R. O'Brien, 404-955-3518 • For use with any Data General computer including the MV1000 super-minicomputer; requires 128k RAM and 10mb disk storage • Price: $3,000-4,000 per module; Updates: included with maintenance contract • Training: on-site, in-house and manual.

CAMS is a modular, fully integrated package that can be configured to meet the individual needs of different architecture-engineering firms. Basic modules are project-cost control, financial management, scheduling, drawing/production control and spec writing.

559 CES-II
Bradbary & Company, 3609 Shallowford Rd., Suite 206, Atlanta, Ga. 30340—Dan Bradbary, 404-457-5094 • For use with computers running CP/M or MS-DOS; requires 64k RAM and 191k disk storage • Price: $795; Updates: free • Training: manual.

CES-II produces detailed and summary reports for materials and labor costs. Factors in markup for overhead and desired profit. Work can be divided into 16 user-defined sections. Costs and labor can be broken out by vendor, hard cost, total cost and selling price.

560 CFMS
Harper and Shuman, Inc., 68 Moulton St., Cambridge, Mass. 02138—Carrie Izard, 617-492-4410 • Software available stand-alone under lease or license or via service bureau or timesharing; compatible computers include IBM PC and PC-XT; TRS-80 Models 2, 12 or 16; DEC Rainbow; Apple III; DEC-VAX and Prime 250 series • Price: $21,995 one-time license fee for stand-alone; $1,000 per month for lease; Updates: some free, some billable • Training: seminar, in-house, on-site, manual, and computer-aided instruction.

CFMS is a comprehensive and fully integrated financial management system that includes payroll, labor distribution, project control system, time utilization, accounting journals, accounts payable, accounts receivable, general ledger, automated billing and financial statements. Programs are menu-driven. Timesharing programs are updated automatically.

561 CMS COST MANAGEMENT SYSTEM
Educol Inc. P. O. Box 726, San Luis Obispo, Calif. 93406.—Dr. Jens Pohl, 805-489-0806 • For use with Alpha Micro AM-100, 100T, 100L or 1,000 computers; requires 32k RAM and 10mb disk storage • Price: $1,800; Updates: billable • Training: seminar, on-site and manual.

CMS Cost Management System is a microcomputer-based program with three levels of cost estimating: preliminary cost estimates, approximate quantities cost estimates, and detailed quantities cost estimates. The program integrates with *OMS Office Management System* database (see 599 below).

562 COLUMBIA
Concord Management Systems, 6301 Ivy Lane, Suite 500, Greenbelt, Md. 20770—Andrew Walls, 301-345-5300 • For use with IBM PC, PC-XT, 34, 36, Texas Instruments PC, PC-XT Business Series and DEC 350; requires 256k RAM • Price: $9,200 for basic package; optional modules at approximately $2,000 each; Updates: available, costs vary • Training: seminar, in-house, on-site and manual.

Columbia is a full management and accounting system designed for construction companies and design/build firms. Provides for multi-company, union and non-union payrolls. Processes AIA billing and all government reporting. More than 50 separate program modules available.

563 COMPUTER AIDED CONSTRUCTION TAKE-OFF AND ESTIMATING SYSTEM
E. F. Paynter & Associates, Inc., 6508 Westfield Blvd., Indianapolis, Indiana 46220—Edwin F. Paynter, 317-257-7561 • For use with Wang 2200 series minicomputers, Apple Lisa 2, IBM System 36, Burroughs B95, B96, B930 and B1900 • Price: $12,000 for basic system; Updates: included with maintenance agreement • Training: in-house, on-site, manual and help screens.

Computer Aided Construction Take-off and Estimating System calculates and reports quantities, costs and hours for all cost items in a construction project. The take-off function is user-defined with entry

at the cost item or phase level of either dimensions or units. User can override all rates, prices, crews and factors at any time. Estimate summary reports include selection and subtotals by cost item, phase, division and project section and labor and equipment summaries. Estimate results are transferable to EFP or other job-cost systems.

564 CONSTRUCTION ACCOUNTING AND CONTROL SYSTEM
Management Information System Group, Inc., 1710 Shadowood Lane, Suite 220, Jacksonville, Fla. 32207—Michael D. Haines, 904-398-2244 • For use with IBM System 34 or 36 minicomputers • Price: $11,500; Updates: included with maintenance agreement • Training: on-site.

Construction Accounting and Control System is a real-time totally integrated system that permits users to cut purchase orders from take-off estimates and automatically update accounts payable and general ledger. The program is designed primarily for contractors but has applications in large firms administering large projects.

565 CONSTRUCTION BID COMPARISON PROGRAM
Computer Services, P. O. Box 702, Atkinson Mill Rd., Fairmont, N. C. 28340—James C. Atkinson, 919-628-8727 • For use with TRS-80 models 1, 3, 4, 12 and 16; requires 16k RAM and 250k disk storage • Price: $50; Licensed to end user only when purchased or leased; Updates: none • Training: manual and computer-aided instruction.

Construction Bid Comparison Program compiles base and alternate bid information to show low bidder on screen or in a printed report within ten minutes after bid information is input.

566 CONSTRUCTION CONSULTANT ESTIMATOR
The Company of Ma-et, P. O. Box 1786, 1522 San Miguel Ave., Rancho San Diego, Calif. 92077—P. Young, 619-465-0444 • For use with IBM PC, PC-XT, TRS-80 1/2/3/12, Northstar and Apple II+/IIe; requires 64k RAM • Price: $129.95; Updates: billable • Training: in-house, manual and computer-aided.

Construction Consultant Estimator is a data-based file program with user-defined data input for generating job-cost estimates on any level and for any type of construction. Estimates include labor, material, equipment

and lump-sum subcontract breakdown. All functions are menu-selectable, with fill-in-the-blanks inputs, worksheets, help screen and manual tutorial.

567 CONSTRUCTION CONTRACT SUPERVISION

Forsgren, Perkins and Associates, 350 North 2nd East, Rexburg, Idaho 83440—Jim Keller, 208-356-9201 • For use with Wang 2200 MVP/LVP/VP, Wang PC and IBM PC; requires 64k RAM • Price: $1,500; Updates: billable • Training: seminar and manual.

Construction Contract Supervision automates the preparation of construction-cost estimates, bid tabulations, monthly contractor pay estimates and construction progress reports. Accommodates projects with as many as 12 schedules and 22 total contractors. Each schedule may contain as many as 999 bid items—up to the storage limit of the disk.

568 CONSTRUCTION COST ESTIMATING SYSTEM

Computer Services, P. O. Box 702, Atkinson Mill Rd., Fairmont, N. C. 28340—James C. Atkinson, 919-628-8727 • For use with TRS-80 models 1, 3, 4, 12 and 16; requires 48k RAM and 250k disk storage • Price: $600 (lease—$50/mo); licensed to end user only when purchased or leased; Updates: billable • Training: manual and computer-aided instruction.

Construction Cost Estimating System is a series of seven individual sub-programs that provides an estimated cost of a project: Quantity take-off of material; Pricing program; Bidday compiler; Pricing and take-off program; Pricing and take-off for mechanical portion of project; Pricing and take-off for electrical portion of project; Bid comparison program.

569 CONSTRUCTION MANAGEMENT SOFTWARE

Small System Design, Inc., 1120 Oakdale Place, Boulder, Colo. 80302—Susan Penny, 303-442-9454 • For use with IBM PC-XT and dot matrix printer • Price: $5,995; includes 16 hours installation and training; Updates: free • Training: in-house, on-site and manual. The estimating portion of

Construction Management Software is useful for specifying materials. Each item can be chosen from a master file of frequently used items and inserted into a job file with quantity and cost figures. The same format can then be used by the contractor to complete the materials list for the job.

570 COST-ACUMEN

Computer Applications Corporation, 2400 Poplar Ave. Suite 318, Memphis, Tenn. 38112—John Cox, 901-458-8630 • For use with most microcomputers running PC-DOS, MS-DOS, CP/M-86 and TRS-DOS (some CP/M-80 machines); requires 128k RAM • Price $595; Updates: billable • Training: manual.

Cost Acumen is a project-oriented cost-accounting software program that tracks, audits, stores, compares figures and checks cost-accounting data. The program is menu-driven and uses a fill-in-the-blanks format for data input. Produces a wide variety of management/accounting reports.

571 CREATIVE MANAGEMENT SYSTEM

CMS International Corporation, 7 Squirrel Tree Rd., LeCanto, Fla. 32661—Robert C. Haag 904-746-2785 • For use with: IBM 370/158 running OS-VS or NASC 7000 • Price: $3,000 to $10,000 per month, per project—depending on volume; Updates: billable • Training: seminars, in-house, on-site, manual and computer-aided instruction.

Creative Management System is a modular, management information system that integrates CPM scheduling, resource analysis, accounting, estimating, purchasing, and cost control. Reports data at various levels of detail through use of a multi-level work breakdown that allows activities to be maintained at low levels of detail for analysis and summarized at high level for review by management.

572 CROSS REFERENCE

EMA Management Associates, Inc., 1145 Gaskins Rd., Richmond, Va. 23233—Terri C. Connell, 804-740-8332 • For use with TRS-80 Model 2, 3, 4, 12, 16, two disk drives, 48k RAM and an 80-character-or-larger printer • Price: $149—$195; Updates: free • Training: manual and computer-aided instruction.

Cross Reference runs interactively with *Assistant Manager* (see listing 554 above), and expands its data-gathering and report-writing capabilities.

573 DESIGN ESTIMATOR

McGraw-Hill Cost Information Systems, P. O. Box 28, Princeton, N. J. 08540—Paul Piccione, 800-257-5295 • For use with Apple II+/IIe/III or IBM PC; requires 64k RAM, two disk drives and printer • Price: $795; Updates: billable • Training: manual.

Design Estimator produces a preliminary design estimate to project the construction cost of a building using preliminary design sketches. Uses a continuously updated database that includes costs for more than 25,000 building components and the productivity and wage rates of 22 trades in more than 700 locations.

574 DODGE SYSTEM 1

McGraw-Hill Cost Information Systems, P. O. Box 28, Princeton, N. J. 08540—Paul Piccione, 800-257-5295 or 609-921-6500 • Service Bureau—requires teletype-compatible computer terminal or microcomputer and a Bell-compatible 300- or 1200-baud modem • Price: varies; Updates: free • Training: seminar and manual.

Dodge System 1 assists in the development of detailed cost estimates that can be used to evaluate contractor's bids and check costs using detailed drawings. The software uses a continuously updated database that includes the cost of more than 25,000 building components and the productivity and wage rates of 22 trades in over 700 locations.

575 DODGE SYSTEM 73

McGraw-Hill Cost Information Systems, P. O. Box 28, Princeton, N. J. 08540—Paul Piccione, 800-257-5295 or 609-921-6500 • Service Bureau—requires teletype-compatible computer terminal or microcomputer and a Bell-compatible 300- or 1200-baud modem • Cost: fee varies; Updates: free • Training: seminar, manual and 800-number.

Dodge System 73 is a preliminary-design estimating tool that projects the construction cost of a building using preliminary design sketches. The program employs a continuously updated database that includes costs for more than 25,000 building components and the productivity and wage rates of 22 trades in more than 700 locations.

576 DODGE SYSTEM 90

McGraw-Hill Cost Information Systems, P. O. Box 28, Princeton,

N. J. 08540—Paul Piccione, 800-257-5295 or 609-921-6500 • Service Bureau—requires teletype-compatible computer terminal or microcomputer and a Bell-compatible 300- or 1200-baud modem • Cost: varies; Updates: free • Training: seminar, manual and 800-number.

Dodge System 90 automates the development of a conceptual budget analysis required to project construction costs of a proposed building design before blueprints are prepared. The program uses prevailing labor and material costs for the zip-code area in which a proposed building is to be constructed.

577 ESPRI

Contractor's Management Systems, 1760 Reston Ave., Suite 101, Reston, Va. 22090—Jim Girardi, 703-435-3172 • For use with IBM PC-XT and compatible computers running MS-DOS or CP/M • Price: $2,995; Updates: billable • Training: seminars, in-house, on-site, manual and computer-aided instruction.

Espri is a user-definable estimating package operating under MS-DOS or CP/M that can track up to 16,000 items (variables) and 999 distinct jobs. The program uses item or assembly-system take-offs. Information is screen-available and can be created, changed or deleted at any time. Over 1000 installations nationally.

578 ESTEK

McDonnell Douglas Automation Company, (McAuto) Management Control Systems, P. O. Box 516, St. Louis, Mo. 63166—W. Eric McDougal, 314-232-6266 • For use with IBM 370, 30XX, 43XX, OS-VS-MVS, 133 column printer, YSAM, 9-track tape drive; requires 1024k RAM • Price: paid-up or monthly—contact McAuto sales office; Updates: billable • Training: seminar, in-house and on-site.

Estek is a construction-cost-estimating system for preparing detailed estimates. The program was designed in conjunction with R. S. Means and CMSI/Smith, Hinchman & Grylls. Estimates can be based on user-defined cost files or in conjunction with optional R. S. Means data. System may be customized for particular types of construction with user-developed work packages.

Project cost analysis and control

579 ESTIMATE
S&R Cerati, Architects, Piazza Europa 26, Cuneo, Italy 12100—Rudolfo Cerati, 66 291 • For use with: IBM PC and compatibles; requires two 5 1/4-in. floppy drives • Price: $75; Updates: billable • Training: manual.

Estimate produces detailed construction-cost estimates. Spreadsheet-like input/output operation offers instant recalculation of values. Converts cost estimates into a spreadsheet format with one keystroke. Program integrates with *The Record Bank* filing and reporting database system (see listing 520 above).

580 FULLY INTEGRATED A/E PROJECT MANAGEMENT/GENERAL ACCOUNTING
ACCI Business Systems, Inc., 4625 N. Freeway, Suite 200, Houston, Texas 77022—Paul Pamer, 713-697-3566 • For use with IBM PC-XT, Compaq Plus, Televideo 806, Altos and Vector Graphic under CP/M or MS-DOS operating systems; requires 64k RAM and 10mb disk storage • Price: $6,250; Updates: billable at price of diskettes and mailing • Training: on-site (travel plus $1000).

Fully Integrated A/E Project Management/General Accounting consists of four integrated modules that emulate the structure of the CFMS/AIA Standardized Accounting for Architects. Entry of time-sheet and expense data updates all project files and all related accounting files. Individual modules are project management/billing, payroll management, accounts payable and general ledger.

581 G/C CUE
Gilbert/Commonwealth, P. O. Box 1498, Reading, Pa. 19603—Paul DeMeo, 215-775-2600 • For use with Hewlett-Packard 3000, Prime, DEC-VAX and IBM 370, 30XX and 43XX computers • Price: from $39,500 depending on hardware and software configuration; Updates: free first year, billable thereafter • Training: on-site, in-house, manual and seminars.

G/C Cue is a comprehensive minicomputer system for large A/E firms that integrates project planning, scheduling and management functions with costing and accounting capabilities. Maintains data for over 1,200 projects separately on one system. Can support up to 100 users simultaneously.

582 GALAXY
R. S. Means Co., Inc., 100 Construction Plaza, Kingston, Mass. 02364—Priscilla Driver, 617-747-1270 • For use with IBM PC-XT, Datamaster and Wang PC; requires 128k RAM • Price: $14,170; Updates: billable • Training: on-site and manual.

Galaxy is an automated quantity take-off and pricing system that enables a user to do a take-off and cost out a project directly from the drawing using a digitizer. Provides unit prices, extended costs, and total costs for all building components. Users can develop files of cost data or use data already contained in the file.

583 IIE MICROSOFTWARE: ECONOMIC ANALYSIS GROUP
Industrial Engineering and Management Press, Institute of Industrial Engineers, 25 Technology Park, Norcross, Ga. 30092—Chuck Smith, 404-449-0460 • For use with Radio Shack TRS-80 Model 1, 3 or 4; Apple Models II/II + /IIe or III • Price: $175—$140 for members; Updates: none planned • Training: seminars, manual and help-line.

Economic Analysis Group comprises four stand-alone programs used to evaluate different aspects of a project's economic feasibility. Documentation includes printed source code. Programs are Buy-versus-Lease Decision, Rate-of-Return Analyzer, Decision-Tree Analysis and After-Tax Cash Flow Analysis.

584 INCOME PROPERTY ANALYSIS
Micro-Mode, Inc., 4006 Mt. Laurel, San Antonio, Texas 78240—Bill Henderson, 512-341-2205 • For use with IBM PC, Compaq, Televideo, Vector, Altos and other microcomputers running CP/M or MS-DOS; requires 64k RAM • Price: $1,995; Updates: billable • Training: manual.

Income Property Analysis produces a complete financial feasibility study on a project for a prospective income property developer to take to the mortgage banker. Used by architects to sell their design services to developers. Also used by property development firms and commercial loan officers. Software was designed by a San Antonio architect.

585 INTEGRATED PROJECT MANAGEMENT/GENERAL ACCOUNTING SYSTEM
BST Consultants, Inc., P. O. Box 23425, Tampa, Fla. 33623—Carlos Baldor, 813-961-3902 • For use with IBM PC-XT, Televideo computers with hard disk and NEC APC with hard disk; requires 64k RAM; turnkey package available with Televideo hardware • Price: $6,250; Updates: free for 90 days, $650 per year thereafter • Training: in-house and manual; 4-day on-site training included with turnkey package.

Integrated Project Management/ General Accounting System is a series of integrated programs designed to meet the needs of A/E firms for control and audit of costs and revenues. Incorporates features of the AIA standardized accounting system and the uniform cost accounting system defined by the ACEC. Entry of time sheets and expense data updates all project files and all related files such as payroll, accounts payable/receivable and general ledger. Will accommodate hundreds of active projects and several hundred employees.

586 INTERVU/ONE
EMA Management Associates, Inc., 1145 Gaskins Rd., Richmond, Va. 23233—Terri C. Connell, 804-740-8332 • For use with TRS-80 models 3 or 4 • Price: $49; Updates: free • Training: manual.

Intervu/One develops construction-cost estimates. Runs projections that account for varying costs, anticipated inflation and time. Program includes two sub-programs, one containing data on the user's firm and the second, on the client's firm. Projections can be run as often as desired to explore different "what-if" factors.

587 INVEST
Abacus c/o Constech, Inc., 8615 Freeport Parkway, P. O. Box 610663, D. F.W. Airport, Texas 75261-0663—Paul Manweiler, 214-257-1186 • For use with Apple or microcomputers running Unix, CP/M or MS-DOS; requires 64k RAM • Price: $599; Updates: free • Training: manual.

Invest is an investment optimization and appraisal model for determining the most profitable design mix/program elements by balancing construction costs, specification levels, zoning constraints, spatial requirements and relationships, land costs, rental rates and occupancy levels, interest rates, life expectancies and operating costs into one model. *Invest* can then appraise and reappraise the impact of changing any one of these factors to improve the rate of return.

588 JOB CAPTAIN
EMA Management Associates, Inc., 1145 Gaskins Rd., Richmond, Va. 23233—Terri C. Connell, 804-740-8332 • For use with TRS-80 models 3 or 4, with two disk-drives and 48k RAM; requires Tandy's Profile III and Data Base Management Program • Price: $95; Updates: free • Training: manual.

Job Captain calculates net and gross square footages of spaces and probable construction-cost budgets. Prints reports for programming, space planning and adjacencies. Prints door and room-finish schedules and remembers all doors, jambs and frame material. Manages and prints complete shop drawing file. Uses fill-in-the-blank multiple screens for inputs.

589 JOB COST ACCOUNTING PROGRAM
Elite Software Development, Inc. P. O. Drawer 1194, Bryan, Texas 77806—Terri J. King, 409-775-1782 • For use with microcomputers running CP/M, MS-DOS, PC-DOS and CP/M-86; requires 56k RAM for CP/M and 128k for MS-DOS • Price: $495; Updates: billable • Training: manual.

Job Cost Accounting Program tracks job costs for up to 500 projects and 50 employees on a perpetual-time basis. Up to 15 hourly task codes, 5 direct cost codes and 15 overhead cost codes are allowed. All reports can be obtained with various qualifying parameters, such as the range of job numbers, range of employees and level of detail.

590 KEYSTONE PROJECT MANAGEMENT SYSTEM
Keystone Project Management Systems, 235 S. Maitland Ave., Maitland, Fla. 32751—Stan Levine 305-628-1832 • For use with

computers running CP/M, CP/M-86, MS-/DOS and PC-DOS (includes computers from Texas Instruments, Digital Equipment Corporation, IBM and Wang); CP/M requires 53k RAM, 128k for all others; turnkey hardware package provides 46mb of disk storage • Price: $4,500— $6,000 for software; Updates: billable • Training: seminar, in-house, on-site and computer-aided instruction.

Keystone Project Management System is a modular, stand-alone or multiple-user turnkey system with networking and database capability. Software capabilities: Tracks employee time and consultant and vendor transactions. Bills clients, including markup on a project-by-project basis. Generates payroll records and checks, while figuring withholding and deductions. Budgets jobs by up to three levels. Prints project status reports and profit-and-loss reports. Data entry screen uses fill-in-the-blanks. Modules available for general ledger, word processing and CADD.

591 LIFE CYCLE COSTING PROGRAM
Elite Software Development, Inc., P. O. Drawer 1194, Bryan, Texas 77806—Terri J. King, 409-775-1782 • For use with microcomputers running CP/M, MS-DOS, PC-DOS and CP/M-86; requires 56k RAM for CP/M and 128k for MS-DOS • Price: $295; Updates: billable • Training: manual.

Life Cycle Costing Program is a multiple-phased life-cycle economics program that uses the net present value method to determine the lowest cost among project alternatives. Analyzes both current and projected financial needs by phasing alternatives over a specified period of time. Accommodates up to four phases with 40 years useful life per project.

592 MAC-MANAGEMENT ACCOUNTING AND CONTROL
DDS—Dakota Data Services, Inc., P. O. Box 1858, Rapid City, S. D. 57709—Jim Van Loan, 605-342-2502 • For use with most Data General microcomputers and mainframes • Price: $6,000 for base system, which includes general ledger, job-accounting/accounts receivable and payroll; price of other modules is approximately $2,000; Updates: billable • Training: on-site and manual.

Mac-Management Accounting and Control was designed around the accounting requirements of professional architectural and engineering firms. The basic system contains general ledger, financial reporting, job accounting, accounts

receivable, payroll and labor distribution. The system can be tailored to the unique needs of a firm.

593 MANAGEMENT INFORMATION SYSTEM
BST Consultants, Inc., P. O. Box 23425, Tampa, Fla. 33623—Chris Meyer, 813-961-3902 • For use with DEC-VAX and Prime Series 50 computers; requires 1mb RAM; turnkey package available based on DEC-VAX hardware • Price: $25,000; lease available for $2,500 per month—min. 1 year; Updates: free for first 6 months, billable thereafter • Training: manual and 10 man-days on-site training included in purchase price.

Management Information System assists in monitoring and controlling costs, revenue and project performance on a real-time basis. Labor costs are computed from employee time-sheet entries and other direct expenses are collected from vouchers, disbursements and journal entries. Information is maintained and displayed on a project, task-phase, department/discipline and activity basis.

594 MICOS
Constech, Inc., 8615 Freeport Parkway, P. O. Box 610663, D. F. W. Airport, Texas 75261-0663—Paul Manweiler, 214-257-1186 • For use with Altos 68000, Plexus and other microcomputers running Unix; requires 512k RAM and 40mb hard disk • Price $17,500; Updates: included with service/maintenance contract • Training: in-house and manual.

Micos is the new generation of the *Orr* Cost Management System. *Micos* incorporates a structured construction cost database of more than 25,000 detailed items, composite systems and buildings. Users may add to this database or substitute their own. Database manager performs report-writing and immediate or summary decision cost analyses. *Micos* integrates with numerous professional and general applications software programs.

595 MISTER PROJECT MANAGEMENT SYSTEM
Park Engineering Associates, P. O. Box 354, Veradale, Wash. 99037—Joseph Powell, P. E., CPL, 509-458-4720 • For use with Prime and DEC-

VAX computers; includes super minicomputers • Price: $7,000—$80,000 depending on hardware required; Updates: included with service/maintenance agreement; billable otherwise • Training: seminars, in-house and manual.

Mister Project Management System is a multi-project management system which integrates CPM-based work schedules and resource leveling with a complete project budget and accounting system. The system supports extensive network and financial graphics, including precedence diagramming. The program will run on supermini-class computer hardware.

596 MONITOR
The Clements Company, 936 Alice Lane, Menlo Park, Calif. 94025—Tom Clements, 415-321-1617 • For use with any computer running CP/M or MP/M and a 132-column printer; requires 64k RAM • Price: $495; $895 with source code; Updates: billable • Training: manual.

Monitor is a package for job-costing and budgeting that permits a selection from the four common types of billing contracts: cost-plus-fixed-fee, lump-sum, per diem, or multiplier. Allows eight, user-definable, direct expense categories.

597 N5500
Nichols & Company, Inc., 5839 Green Valley Circle, Suite 104, Culver City, Calif. 90230—Patrick M. Mazie 213-795-0813 • For use with IBM, HP, Burroughs, Honeywell, Univac, CDC, Perkin Elmer, Wang, Prime, Data General and DEC computers • Price: $28,000; Updates: included with maintenance contract • Training: seminars, in-house and on-site.

N5500 is an integrated management information system for project planning and control. Handles budgeting, accounting, billing, resource management, CPM/PERT scheduling, reports and report graphics. Handles over one billion projects, dependencies, resource categories and milestones.

598 NIC GENERAL ACCOUNTING
National Information Consultants, Inc., 403 S. Cheyenne, Suite 600, Tulsa, Okla. 74103—Jack Vest, 918-584-2365 • For use with IBM PC-XT, TRS-80 model 2, 12 or 16 with CP/M, Altos 586/986 with Xenix, HP 86/87

and Intertec Headstart • Price: $995; Updates: no charge for first year included with maintenance fee thereafter • Training: in-house, on-site and manual.

Nic General Accounting is a fully integrated accounting system with general ledger, accounts payable, accounts receivable and payroll. Produces financial statements in any format. Payroll is job-oriented allowing entry of project number and work code for each employee. Runs salaried and hourly employees simultaneously. Prints well-designed reports and detailed check stubs. Optional modules are Project Management ($395) and Card Reader System ($195).

599 OMS OFFICE MANAGEMENT SYSTEM
Educol Inc., P. O. Box 726, San Luis Obispo, Calif. 93406—Dr. Jens Pohl, 805-489-0806 • For use with Alpha Micro AM-100, 100T, 100L or 1,000 computers; requires 32k RAM and 10mb disk storage • Price: $3,000; Updates: free • Training: seminar, on-site and manual.

OMS Office Management System is a multi-user system that integrates job information, office accounts, payroll, people and design project data into an automated data storage and report generation system. Additional applications modules available.

600 OPTIM
Constech, Inc., 8615 Freeport Parkway, P. O. Box 610663, D. F. W. Airport, Texas 75261-0663—Paul Manweiler, 214-257-1186 • For use with most microcomputers running Unix or MS-DOS; requires 64k RAM • Price: $499; Updates: free • Training: manual.

Optim combines the major construction and operating cost variables enabling a user to determine the optimum shape, number of stories, layout and external works of a building. Estimates produced by *Optim* can serve as a cost benchmark for comparing alternative schemes.

601 PRELIMINARY COST ESTIMATING
Micro-Mode, Inc., 4006 Mt. Laurel, San Antonio, Texas 78240—Bill Henderson, 512-341-2205 • For use with IBM PC, Compaq, Altos, Vector, Televideo, Osborne and other microcomputers running CP/M or MS-DOS; requires 64k RAM and 150k disk storage • Price: $1,995; Updates: billable at $150 per year • Training: manual.

Preliminary Cost Estimating produces probable construction cost for a construction project. Cost is

broken down into 12 building systems, special building features and site and special outside work. Cost figures are based on Dodge, Means and Marshall figures.

602 PROFESSIONAL ACCOUNTING SYSTEM
Heiniger Associates, 636 W. Jefferson, Morton, Ill. 61550—Jim Heiniger, 309-266-5812 • For use with Wang 2200 System (SVP/LVP/MVP); requires 64k RAM • Price: from $1,500, depending on number of modules purchased; Updates: billable • Training: manual and on-site.

Professional Accounting System consists of integrated job costing/marketing software including payroll, general ledger, accounts payable and word processing. Generates multiple invoice formats. Other modules are projects (Forms 254, 255), contact information, personnel/company information, calendars and labels.

603 PROFESSIONAL JOB COST SYSTEM
DMM & Associates, 1542 W. Wilshire Drive, Phoenix, Ariz. 85007—Dave McKibben, 602-254-9647 • For use with DEC-Decmate I and II, WD78 and WT78 • Price: $1,450 (leasing option available); Updates: free during first year, billable thereafter • Training: manual and on-site.

Professional Job Cost System is a modular suite of programs that can capture and report job-related expenses from employee time cards, outside consultant billings and miscellaneous internal and external expenses. Produces a variety of reports, including billing advice, project performance summary, employee time summaries and labor analysis. Related systems are job-cost estimating, accounts payable, payroll, accounts receivable and general ledger.

604 PROFESSIONAL MANAGER
Automate Computer Software, P. O. Box 290336, San Antonio, Texas 78280—Sadashiv B. Pai, 512-694-4029 • For use with IBM PC-XT and compatibles, HP 150, Wang PC, TI Professional and Victor 9000 • Price: $2,500–$6,000; Updates: free • Training: seminar, in-house, on-site, manual and computer-aided instruction.

Professional Manager is a fully integrated financial accounting system featuring job-cost with billing, payroll, accounts payable, accounts receivable and general ledger. Unix version (language is CDI/100) is also available. Optional report writer permits users to create customized reports. Industry standard graphics and spreadsheet packages interface with the database.

605 PROJECT CONTROL MANAGEMENT SYSTEM
Creative Software Systems, 399 Sherman Ave. Suite 11, Palo Alto, Calif. 94306—Tim Killeen, 415-328-5033 • For use with IBM PC-XT, DEC-PDP/11 or any other computer running SMC; supports most 132-column printers. Also available as part of turnkey system • Price: varies from $5,000-$10,000; Updates: cost depends on complexity of update • Training: in-house, on-site, manual and computer-aided instruction.

Project Control Management System is a modular, fully integrated accounting and financial management system with five main modules: accounts receivable, accounts payable, project costing, general ledger and payroll. One entry updates all files. Optional systems are PERT (scheduling), library distribution, employee scheduling, file-maintenance generator and a report writer.

606 PROJECT COST AND ACCOUNTING SOFTWARE
Data Processing Design, Inc., 1400 N. Brasher, Anaheim, Calif. 92807—Chuck Sargent, 714-970-1515 • For use with VAX/VMS Version 3.4 or later and PDP-11 systems • Price: $20,000 for complete package or $5,000 for each individual module; Updates: included with annual support • Training: on-site, in-house and manual.

Project Cost and Accounting Software is a suite of five programs designed to track labor and expenses for individual client projects. The software generates reports on project profitability and handles all other operational and financial reporting needs with an integrated fiscal accounting package.

607 PROJECT MANAGEMENT
Archon Software, 218 West Main St., Charlottesville, Va. 22901—Stuart G. Burgh, 804-295-2600 • For use with: IBM PC-XT with 10mb hard disk, Corvus Concept Personal Workstation • Price: $4,500; Updates: free • Training: seminar, manual.

Project Management is a costing and accounting system that comprises six integrated software modules to provide in-house project costing, payroll and accounting services. The modules are designed for architectural and engineering firms and are fully integrated with interactive graphic displays.

608 PROJECT MGR.
Applied Digital Communications, 214 Flynn Ave., Moorestown, N. J. 08057—Thomas Concannon, 609-234-3666 • For use with Data General NOVA, Integrated Business Computer and Eclipse microcomputers; requires 256k RAM and 10mb hard disk storage • Price: from $5,000 depending on software configuration; Updates: free • Training: seminar, in-house, on-site and manual.

Project Mgr. is a modular, menu-formatted project management system that provides detailed budget and cost-capturing capability. Included is a professional invoicing system and a personnel reporting module. Software can be purchased as part of a turnkey system that includes documentation, training and ongoing support.

609 PROJECT TIME MANAGEMENT
Alpine Datasystems, Inc., 8043 Southwest Cirrus Dr., Beaverton, Ore, 97005—Steve Judd, 503-641-8100 • For use with DEC-PDP-11 and VAX series of computers; requires 256k RAM and 20mb hard disk storage • Price: $12,000 to $40,000 depending on configuration; Updates: billable • Training: on-site and hot-line.

Project Time Management is an integrated project costing and financial accounting system oriented towards medium-to-large firms using minicomputers. Package includes project costing, accounts receivable, billing, payroll, accounts payable, general ledger, resource scheduling and marketing retrieval. Determines actual costs versus budgeted costs for labor, reimbursables, consultant expenses and direct costs.

610 PROMAX-C
Minicomputer Concepts, Inc., One Ames Court, Plainview, N. Y. 11803—Robert Latania, 516-349-1910 • For use with any computer running PICK, including Micro Data, Altos and IBM PC-XT • Price: from $10,000 for basic software; Updates: billable • Training: seminar, in-house and manual.

Promax-C is a modular financial cost-control system built around a billing and job-costing module and an on-line database. Standard modules are accounts receivable, accounts payable, general ledger and payroll. Options are job-cost estimating, job scheduling, vehicle/equipment maintenance, inventory/purchasing control, fixed assets accounting, personnel reporting and mailing list maintenance.

611 RAPIDCOST-C
Chempro Data Sciences Corp., 507 Southampton Rd, Westfield, Mass. 01085—Norman St. Martin, 413-562-2358 • For use with: IBM PC-XT with monochrome monitor, Compaq portable and IBM portable; supports Digitrak sonic digitizer • Price: $4,685; includes digitizer; Updates: free during first year, billable thereafter • Training: seminar, in-house, on-site, manual, computer-aided instruction and telephone support.

Rapidcost-C is a contractor estimating and take-off system that operates in conjunction with a sonic digitizer. The program stores details and sub-assemblies along with prices and other related information in a database. Digitizer permits take-offs of quantities, areas, lengths and widths and conversion to squares, rolls and other building material units.

612 REQUEST FOR PAYMENT PROGRAM
Computer Services, P. O. Box 702, Atkinson Mill Rd., Fairmont, N. C. 28340—James C. Atkinson, 919-628-8727 • For use with TRS-80 models 1, 3, 4, 12 and 16; requires 32k RAM • Price: $100; Licensed to end user only when purchased or leased; Updates: billable • Training: manual and computer-aided instruction; questions answered by phone.

Request for Payment Program stores data by request period. After user initializes program for project he only changes the amounts for each breakout. The program computes the remainder of the entries on a form that prints out on a 132-column printer.

613 SOLOMON III ACCOUNTING SOFTWARE

Computech Group Inc., Main Line Industrial Park, Lee Blvd., Frazer, Pa. 19355—Peter Drinkwater, 215-644-3344 • For use with IBM PC-XT; requires 256k RAM and a hard disk • Price: $595 per module; Updates: free • Training: manual.

Solomon III is a general accounting package built on a "core" general ledger module. Optional modules include standard accounting functions and job costing. Information put into any module can be automatically posted in general ledger. Add-on report writer, *MDBS Query,* can extract unrelated information from a database for customized reports.

614 SOLOMON SERIES III

TLB, Inc., P. O. Box 414, Findlay, Ohio 45839—Fran Lucy, 215-644-3344 • For use with IBM PC-XT, Victor 9000, DEC Rainbow 100+ and TI Professional • Price: $595; additional modules priced from $150 to $995; Updates: free during first six months, billable thereafter • Training: seminar, in-house, on-site and manual.

Solomon Series III is a 12-module accounting package based on a general ledger module. Other modules are job-costing, accounts payable, accounts receivable, payroll, fixed assets, inventory, purchasing, order entry, sales analysis, address and mail list and Solomon reporter.

615 STANDALONE PROJECT COST ACCOUNTING

Micro-Mode, Inc., 4006 Mt. Laurel, San Antonio, Texas 78240—Bill Henderson, 512-341-2205 • For use with IBM PC, Compaq, Televideo, Altos; and other microcomputer running CP/M or MS-DOS; requires 64k RAM and 240k disk storage • Price: $1,645; Updates: billable • Training: manual.

Standalone Project Cost Accounting tracks budgeted versus actual costs, labor and billable amounts for up to 500 projects and 100 employees. Records time and money spent on each project by phase, job service within each phase and labor billing rate. Also records direct and reimbursable costs by project. Produces a variety of summary and detailed reports by both billing rate and pay rate each pay period.

616 STAR

R. S. Means Co., Inc., 100 Construction Plaza, Kingston, Mass. 02364—Priscilla Driver, 617-747-1270 • For use with IBM PC-XT, IBM Datamaster, Wang Professional and DEC Rainbow 100 plus; requires 128k RAM • Price: $1,600; Updates: billable • Training: manual.

Star is a general estimating program using the unit price method. User can develop his own material and labor-cost information. Produces estimating reports for an entire project broken down by subcontracts or full 16 divisions.

617 WIND-2 ONE

Wind-2 Research, Inc., 419 Canyon Ave., Suite 224, Ft. Collins, Colo. 80521—L. Danielle Forsyth, 303-482-7145 • For use with any computer running MS-DOS or CP/M with at least 64k RAM, two disk drives, an 80-column monitor and form-feed printer • Price: $1,395; Updates: billable • Training: on-site, manual and help-line.

Wind-2 One uses standard, readily available accounting data to provide project management, project invoicing, project profit analysis, overhead cost analysis, accounts receivable and labor and task evaluation and management. Also includes cost proposal/job cost.

623 ARCHITECT'S FRIEND—V1.1

Team Design, 5290 North Picket Dr., Colorado Springs, Colo. 80907—Bob Moore 303-598-0663 • Program operates as part of a turnkey system or with IBM PC and compatible computers running MS-DOS. Peripherals include PGS MAX-12 and Color Graphics XL-19 monitors; Houston Instruments DMP-52 plotter; SAC Sonic digitizer and NEC P-3 printer • Price: from $2,895 for software; $27,995 for turnkey package; Updates: free; modem option • Training: in-house, on-site, manual, computer-aided instruction and video-training cassettes.

ARchitect's Friend—V1.1 is an integrated graphics-based applications package that includes project management, energy analysis, full accounting, floor plans, elevations, renderings and development planning. The program is written in "C" language for transportability and uses a standard file management database.

624 ARCHPAK

Integrated Technical Computers Co. Ltd., 42 Road 5 Ampang Jaya, Kuala Lumpur, Malaysia—Lim Tong Leong 03-466134 • For use with Apple, IBM PC and compatible computers; requires 64k RAM • Price: $1,950— $2,950; Updates: billable • Training: manual.

Archpak is a menu-driven database information system that assists with job costing, progress payment, variation orders, time extension control, status of authorities approvals and other related activities during the construction stage. Program utilizes error trapping programming techniques.

625 ARTEC 3

Go Fukai, P. O. Box 330040, San Francisco, Calif. 94133—Dennis Fukai, 415-824-3093 • For use with Macintosh and Lisa with optical or laser printer; requires 512k RAM and a 5mb hard disk • Price: $1,300/yr. license; Updates: billable • Training: on-site and computer-aided instruction.

Artec 3 categorizes material and cost data established in "keyroom" references developed by *Artec 2* (see also 697 and 698). Construction management and cost information are updated as design and/or specification changes are finalized. Output is interfaced with graphic references and is intended to provide continuous construction support through on-site computer hardware.

626 ARTEMIS

Metiert Management Systems, 5884 Point West Dr., Houston, Tex. 77036—Robert B. Walker, 713-988-9100 • For use with IBM PC-XT, HP 150, HP 1000, and IBM 4341 Group 2 • Price: $80,000 and up; Updates: free • Training: in-house, on-site and manual.

Artemis is an interactive project management system for planning and scheduling, cost management, performance measurement, resource leveling, materials control, forecasting, maintenance and documentation/drawing control. *Artemis* features a relational database for full integration of information and operates under one English-like control language.

627 ASAPMS PROJECT MANAGEMENT SYSTEM

ASA-Andrew Sipos, 355-26B South End Ave, New York, N. Y. 10280—Andrew Sipos, 212-321-2408 • For use with IBM 360/370/303X/42XX, CDC 6600/7600, DEC-PDP-10/20/11/VAX or Prime; Input devices are a CRT or hardcopy terminal; output devices: printer, hardcopy terminal or plotters with a width of 11 in. or more • Price: from $9,000; Updates: billable • Training: seminar, in-house, on-site, manual and computer-aided instruction.

Asapms Project Management System is a modular project management system that plans, schedules, compares the project plan with actual job performance, and reports the amount of work remaining to be done. Independent scheduling systems are critical path method, precedence method, PERT, and progress chart. Each scheduling system comprises five programs: time analysis (core program), cost, resource, graphics and multi-project.

628 CRITICAL PATH METHOD

Technical Information Systems, Inc., 116 West Plume St., P. O. Box 1900, Norfolk, Va. 23501—Robert E. Branch, 800-368-4203 • For use with DEC-VAX and PDP-11 • Price: $995 for VAX; $895 for PDP-11; Updates: free for first ninety days; included with maintenance contract thereafter • Training: on-site, in-house, manual and computer-aided instruction.

Critical Path Method computes critical path for medium-to-large construction projects with a maximum of 1,000 individuals tasks.

3

Sorts by early start, late start, early finish, late finish, total float, bid items and sequentially. Dollar values for each task and total for project are printed by option.

629 CRITICAL PATH METHOD PROGRAM

Elite Software Development, Inc., P. O. Drawer 1194, Bryan, Tex. 77806—Terri J. King, 409-775-1782 • For use with microcomputers running CP/M, MS-DOS, PC-DOS and CP/M-86; requires 56k RAM for CP/M and 128k for MS-DOS • Price: $249; Updates: billable • Training: manual.

Critical Path Method Program permits up to 500 activities to be defined in a network. Enables users to define working days, time increments, skill categories and cost methods. Outputs include summary reports on the status of all activities and Gantt charts.

630 CRITICAL PATH (PERT) MODULE

Chempro Data Sciences Corp., 507 Southampton Road, Westfield, Mass. 01085—Norman St. Martin, 413-562-2353 • For use with: IBM PC-XT, IBM portable computers or Compaq • Price: $250; Updates: billable • Training: manual and telephone support.

Critical Path (PERT) Module permits critical path planning, project scheduling and control. Arcs (time) and nodes (events) are presented to produce the critical path for date-sensitive events that may or may not be contingent on each other. Includes graphic-printout capabilities.

631 G/C CUE

Gilbert/Commonwealth, P. O. Box 1498, Reading, Pa. 19603—Paul DeMeo, 215-775-2600 • For use with HP 3000, Prime, DEC-VAX and IBM 370, 30XX and 43XX • Price: from $39,500 depending on hardware and software configuration; Updates: free first year, billable thereafter • Training: on-site, in-house, manual and seminars.

G/C CUE is a comprehensive minicomputer system for large A/E firms that integrates project planning, scheduling and management functions with costing and accounting capabilities. Maintains data for over 1,200 projects separately on one system. Can support up to 100 users simultaneously.

632 GANTT-PACK VERSION 3.0

Gantt Systems, Inc., 495 Main St., Metuchen, N. J. 08840—Peter H. Malone, 201-494-7452 • For use with any computer running the following operating systems: MS-DOS or PC-DOS 2.0 or later; CP/M-80; TRS-DOS; Unix or Xenix; RAM requirements vary; requires 132 column printer • Price: $395; Updates: billable • Training: manual.

Gantt-Pack Version 3.0 is a project control tool for scheduling by specific date, time or any user-defined units. Draws Gantt and critical milestone charts. Charts can be output into a word processor through an ASCII file to create customized reports. Also interfaces with Lotus 1-2-3 or basic language.

633 HARVARD PROJECT MANAGER V1.1

Harvard Software, Inc., 521 Great Rd., Littleton, Mass. 01460—Daniel S. Diamond, 617-486-8431 • For use with IBM PC, PC-XT and compatible computers, such as Compaq and Hyperion; requires 128k RAM and two disk drives; supports 8 printers, including IBM, Epson, C. Itoh, NEC and Okidata Microline • Price: $395; Updates: free or at cost • Training: seminars through dealers and manual.

Harvard Project Manager V1.1 utilizes the critical-path method (CPM) and program-evaluation-and review technique (PERT) scheduling methods. Inputs are tasks, subprojects and milestones. Task durations can be assigned a cost and specified from minutes to years of "working" or "elapsed" time. Other program features are user-definable calendar, functional windows, a selection of on-screen or printed displays and reports and the use of the large PC character set to construct graphical elements for printed charts.

634 IIE MICROSOFTWARE: PROJECT MANAGEMENT GROUP

Industrial Engineering and Management Press, Institute of Industrial Engineers, 25 Technology Park, Norcross, Ga. 30092—Chuck Smith, 404-449-0460 • For use with TRS-80 Models 1, 3, 4; Apple Models II, II+, IIe and III and IBM PC • Price: $175, $140 for members; Updates: none planned • Training: seminars, manual and help-line.

IIE Microsoftware: Project Management Group comprises four software programs: Critical Path Analysis, Program Evaluation and Review Technique (PERT), Resource Allocation and Activity-on-Node Network Analysis. Each of the programs schedules projects on the basis of time and resources. Documentation includes printed source code.

635 LISAPROJECT

E. F. Paynter & Associates, Inc., 6508 Westfield Blvd., Indianapolis, Ind. 46220—Edwin F. Paynter, 317-257-7561 • For use with Apple Lisa 2 • Price: $395, Updates: no information provided • Training: manual.

Lisaproject schedules and tracks complex projects using schedule, resource and task charts displaying the critical path and task interdependencies. Accepts data directly from *EFP's Computer-aided Construction Takeoff and Estimating System* (see listing in Section 2).

636 MAPPS (MANAGEMENT AND PROJECT PLANNING SYSTEM)

Mitchell Management Systems, Inc., Westborough Office Park, 2000 West Park Drive, Westborough, Mass. 01581—R. B. Daluga, 617-366-0800 • For use with Data General MV, DEC-VAX and Wang VS; requires 1mb RAM • Price: $65,000 with Graf-Plot; also available for lease at $4,000 per month; Updates: billable • Training: seminar, in-house, on-site and manual.

MAPPS (Management and Project Planning System) is a network-based, critical path method tool for capturing, recording, analyzing, manipulating and forecasting all the information necessary for complete project planning and control. The menu-driven program controls time, cost and resources. An optional Graf-Plot package provides the capability to produce virtually all the numeric information produced by the basic *MAPPS* program in a multi-color graphic form.

637 MILESTONE

Digital Marketing Corporation, 2363 Boulevard Circle, Walnut Creek, Calif. 94595—Debbie Goldstein, 1-800-826-2222 • For use with Z80, 8080 or 8085 computers running CP/M; an 8086 computer with CP/M-86; Apple II with a language card; Apple Pascal 1.1 or Z80 softcard and a 24 by 80 video board; IBM PC or Victor 9000 • Price: $295; Updates: billable • Training: manual.

Milestone is a project-management and time-scheduling program that uses a critical path network analysis to schedule manpower, dollars and quarters. Time units are measured in hours, days, weeks, months and quarters. The program generates reports and large time-schedule charts. It can link several jobs together into one project schedule.

638 MISTER PROJECT MANAGEMENT SYSTEM

Park Engineering Associates, P. O. Box 354, Veradale, Wash. 99037—Joseph Powell, P. E., CPL, 509-458-4720 • For use with Prime and DEC-VAX computers; includes super minicomputers • Price: $7,000—$80,000 depending on hardware required; Updates: included with service/maintenance agreement; billable otherwise • Training: seminars, in-house and manual.

Mister Project Management System is a multi-project management system which integrates CPM-based work schedules and resource leveling with a complete project budget and accounting system. The system supports extensive network and financial graphics including precedence diagramming. The program will run on supermini-class computer hardware.

639 MMS-II

North America MICA, Inc., 5320 Carrol Canyon Rd., Suite 110, San Diego, Calif. 92121—Diana Hamper, 619-458-1327 • For use with most microcomputers with 64k RAM; requires an 80-character by 24-line video display, 132-column printer and a minimum of 600k disk storage in two drives • Price: $995; Updates: free during first year, billable thereafter • Training: manual.

MMS-II is a materials management sub-system to *PMS-II* (see 648 below) that gives a project manager control of all materials to be used in a *PMS-II* project. As many as 1000 purchase orders can be entered into the *MMS-II* database for as many as 500 different vendors; and up to 32,000 line items of material can be allocated to activities in *PMS-II* projects.

640 N5500

Nichols & Company, Inc., 5839 Green Valley Circle, Suite 104, Culver City, Calif. 90230—Patrick M. Mazie, 201-795-0813 • For use with IBM, HP, Burroughs, Honeywell, Univac, CDC, Perkin

Elmer, Wang, Prime, Data General and DEC computers • Price: $28,000; Updates: included with maintenance contract • Training: seminar, in-house and on-site.

N5500 is an integrated management information system for project planning and control. Handles budgeting, accounting, billing, resource management, CPM/PERT scheduling, reports and report graphics. Capable of handling over one billion projects, dependencies, resource categories and milestones.

641 NIC MANPOWER SCHEDULING

National Information Consultants, Inc., 403 South Cheyenne, Suite 600, Tulsa, Okla. 74103—Jack Vest, 918-584-2365 • For use with IBM PC-XT, TRS-80 2, 12 and 16 with CP/M, Altos 586/986 with Xenix, HP 86/87 and Intertec Headstart • Price: $295; Updates: no charge first year billable thereafter • Training: in-house, on-site and manual.

NIC Manpower Scheduling combines all project schedules entered by department and compares the result with the firm's available resources. Produces departmental report to enable a scheduler to anticipate hiring and layoff periods.

642 PATHFINDER

Garland Publishing, 136 Madison Ave., New York, N. Y. 10016—Craig Randall, Jeff Conrad, 212-686-7492 • For use with any CP/M-80-8 bit microcomputer with 48k RAM and 100k disk storage; or IBM PC or PC-XT with 128k RAM and 150k disk storage • Price: $299; Updates: free • Training: manual.

Pathfinder is a menu-driven program for critical-path-method project scheduling that generates a variety of charts and reports: Gantt-chart plot on printer, exception report, cash-flow projection and work day/date conversion chart. Reports can be sorted many different ways.

643 PCM

Constech, Inc., 8615 Freeport Parkway, P. O. Box 610663, D. F. W. Airport, Texas 75261-0663—Paul Manweiler, 214-257-1186 • For use with Altos, Plexus, IBM PC or microcomputers running Unix, MS-DOS or CP/M; requires 128k RAM • Price: $3,000—$5,000; Updates: free • Training: manual.

PCM is a project control and management package for setting up, monitoring and forecasting services, contractors, suppliers with manpower, materials/equipment, unit rates, work order progress, productivity and cash flows (working capital). Features include a flexible database manager, user-defined work breakdown structures, earned value/BCWS/BCWP/EAC reporting, trend analysis and full simulation, overtime and holidays.

644 PERT 6

Dynamic Solutions, Inc., 50 Lytton Ave., Hartsdale, N. Y. 10530—A. J. Paris, 914-949-6058 • For use with DEC System 10, System 20, VAX/VMS, Alpha-Micro/AMOS/L and other 32-bit computers; disk storage-requirements depend on size and number of projects • Price: from $39,000; Updates: billable • Training: manual and on-site.

Pert 6 is a modular, database-oriented system for project planning, tracking and control that offers fully user-defined reports, immediate on-line error detection, multiple calendars and either precedence or I-J notation. Wide range of input options. Interfaces with other software.

645 PLAN TRAC

Computerline Limited, 755 Southern Artery, Quincy, Mass. 02169—Susan Carroll, 617-773-0001 • For use with most microcomputers running MS-DOS, PC-DOS, TRS-DOS and CP/M; supports flatbed or drum plotters and 132-print position serial/parallel printer • Price: $3,000 first year, $1,000 per year thereafter; includes technical support, all software updates and plotter; Updates: included with license fee • Training: seminar, in-house, on-site and manual.

Plan Trac is a menu-driven scheduling program that performs critical-path-method network planning and time, resource and cost analyses. Produces reports to highlight and compare specific schedule, cost and resource activities on a screen or printer in user-definable formats. Plots or prints the network drawing and bar chart. Permits data transfer to other systems.

646 PLAN TRAC-CS

Computerline Limited, 755 Southern Artery, Quincy, Mass. 02169—Susan Carroll, 617-773-0001 • For use with most microcomputers running MS-DOS, PC-DOS and CP/M; supports flatbed and large drum plotters • Price: $3,000 first year, $1,000 per year thereafter; includes technical support, all software updates and plotter software; Updates: included in license fee • Training: seminar, in-house, on-site and manual.

Plan Trac-CS automates the monitoring and forecasting of construction activities. Maintains a database of project details such as crews, materials, equipment and associated costs. Offers choice of "S" curves. Analyzes performance, variance, cash flow and trending calculations and has facilities for simulations. Reports include earned value, BCWP, ACWP, BCWS and ACWS. Interfaces with *Plan Trac* schedule database to permit actual and baseline schedules to be used to provide time phasing.

647 PMS PROJECT MANAGEMENT SYSTEM

Educol Inc., P. O. Box 726, San Luis Obispo, Calif. 93406—Dr. Jens Pohl, 805-489-0806 • For use with Alpha Micro AM-100, 100T, 100L or 1,000 computers; requires 38k RAM and 10I/mb disk storage • Price: $1,200; Updates: billable • Training: seminars, on-site and manual.

PMS Project Management System is an interactive scheduling and project management system with CPM and PERT network analysis, scheduling and probabilistic risk management. Choice of "precedence" or "activity in the box" network definitions. Activity relationships are finish-to-start, start-to-start, start-to-finish, per cent-complete-to-start, and per cent complete-to-finish.

648 PMS-II

North America MICA, Inc., 5320 Carrol Canyon Rd., Suite 110, San Diego, Calif. 92121—Diana Hamper, 619-458-1327 • For use with most microcomputers with 64k RAM; requires an 80-character by 24-line video display, 132-column printer and a minimum of 600k disk storage in two drives • Price: $1,295: Updates: free during first year, billable thereafter.

PMS-II is a critical path network analyzer that will calculate the early start/finish and late/start/finish dates, float time and critical paths for project networks with up to 2,500 activities. Prints activity reports and Gantt charts with extensive sort and select capabilities, an activity diagram, funding schedule and graph and three-part earned-value analysis reports. (See also 639 and 657.)

649 PRODAT

Technical Information Systems, Inc., 116 W. Plume St., P. O. Box 1900, Norfolk, Va. 23501—Robert E. Branch, 800-368-4203 • For use with DEC-VAX and PDP-11 • Price: $250 for VAX; $150 for PDP-11; Updates: free for first ninety days; included with maintenance contract thereafter • Training: on-site, in-house, manual and computer-aided instruction.

Prodat computes dating sequence for any duration project considering holidays, overtime, etc. Output depicts entire project and relationship of nth day of project to calendar date. Leap years are considered.

650 PROJECT MANAGEMENT PACKAGE

Bradbary & Company, 3609 Shallowford Rd. 206, Atlanta, Ga. 30340—Dan Bradbary, 404-457-5094 • For use with any CP/M or MS-DOS operating system; requires 64k RAM • Price: $695 series, $295 each; Updates: free • Training: manual.

Project Management Package contains four programs: contractor application for payment (completes AIA 0703 form); contractor material control; contractor shop drawing/submittal control; contractor drawing/specification control.

651 PROJECT MANAGEMENT SOFTWARE

Mason & Hanger—Silas Mason Co. Inc., 200 West Vine St., Lexington, Ky. 40507—Elizabeth Boorman or Bill Allman, 606-252-4421 • For use with any 64k microcomputer running CP/M, MP/M or CP/M-86; requires an 80-character by 24-line video display, and a 132-column printer • Price: $1,295; Updates: free first year; billable thereafter • Training: seminars, in-house, on-site and manual.

Project Management Software performs a critical-path networking analysis that will calculate the early start/finish and late start/finish, float time, and critical paths for project networks to over 2,500 activities. Work week and calendar flexibility. Meets all government reporting requirements per ER-1-1-11 and DOD 7000-2. True float calculations and menu drive. Interfaces with a job-cost system or dBase II.

652 PROJECT MANAGER MODULE

Chempro Data Sciences Corp., 507

Southampton Road, Westfield, Mass. 01085—Norman St. Martin, 413-562-2353 • For use with: IBM PC-XT, IBM portable computers and Compaq • Price: $400; Updates: billable • Training: manual and telephone support.

Project Manager is a stand-alone software module that runs on the IBM PC-XT and compatibles. It offers graphics displays in the form of Gantt and PERT Charts. Multiple projects may be handled. Data is easily viewed and interpreted.

653 PROMAX-C

Minicomputer Concepts, Inc., One Ames Court, Plainview, N. Y. 11803—Robert Latania, 516-349-1910 • For use with any computer running PICK—Micro Data, Altos, IBM PC-XT • Price: from $10,000 for basic software; Updates: billable • Training: seminar, in-house and manual.

Promax-C is a modular financial cost-control system built around a billing and job-costing module and an on-line database. Standard modules are accounts receivable, accounts payable, general ledger and payroll. Options are job-cost estimating, job scheduling, vehicle/equipment maintenance, inventory/purchasing control, fixed assets accounting, personnel reporting and mailing list maintenance.

654 PROMIS

Strategic Software Planning Corporation, 222 Third St, Cambridge, Mass. 02142—Elizabeth A. Weiner, 617-547-0532 • For use with IBM PC-XT or equivalent, color or monochrome display, 1 floppy disk drive and hard disk; requires 512k RAM; fully supports any graphic device driven by the GSX-86 Graphics System Extension by Digital Research, Inc. • Price: $3,000; Updates: free for first year, billable thereafter • Training: seminar, in-house, on-site and manual.

Promis integrates scheduling, resource management, tracking and budget-cost control functions. Handles unlimited number of projects, tasks, costs and resources. Based on Critical Path Method. Over 40 pre-defined reports provided including presentation-quality Gantt charts, histograms, network drawings, resource and cost profiles and tabular formats. Incorporates MDBS-III database structure.

655 PROMPT-ER

Prompter Management Inc., P.O. Box 6641, Station A, Toronto, Canada, M5W1X4—Bill Cornish, 416-884-8374 • For use with Apple II plus or IIe; requires 64k RAM • Price: $189 U. S.; Updates: first update free; billable thereafter • Training: manual.

Prompt-er is a project management and scheduling program that draws network diagrams on screen and permits users to modify them to establish the best relationships between activities and the best project path. Prints out a calendar bar chart.

656 QUICK-PLAN

Mitchell Management Systems, Inc., Westborough Office Park, 2000 West Park Drive, Westborough, Mass. 01581—R. B. Daluga, 617-366-0800 • For use with Data General Desk Top, DEC Rainbow Plus, HP 150, IBM PC-XT, IBM compatibles and Wang PC; requires 384k RAM • Price: $995; Updates: billable • Training: seminar, in-house and manual.

Quick-Plan is a network-based, critical path method decision-support software tool for personal computers. *Quick-Plan* permits users to structure time, cost and resource information in network format, allowing managers to evaluate the cost and resource impact of alternative plans and schedules.

657 RMS-II

North America MICA, Inc., 5320 Carrol Canyon Rd., Suite 110, San Diego, Calif. 92121—Diana Hamper, 619-458-1327 • For use with most microcomputers with 64k RAM; requires an 80-character by 24-line video display, 132-column printer and a minimum of 600k disk storage in two drives • Price: $995; Updates: free during first year, billable thereafter • Training: manual.

RMS-II is a resource management system that tracks all space, staff and material resources. The program is designed to run with *PMS-II*, a critical path program (see 648 above). *RMS-II* generates reports for any of 96 resource centers showing line item detail allocations and bar graphs that depict allocations as a percent of capacity over time.

658 STARNET

Largo Soft International, 1 Hameasfim St. (Eliahu House), Tel-Aviv, Israel 64736—(03) 256876 • For use with computers running MS-DOS or CP/M-86; requires two 320k disk drives and a printer • Price: $1,995: Updates: billable • Training: manual and computer-aided instruction.

Starnet analyzes and solves a node-oriented project network (also known as "precedence" or "activity-on-node" technique). Handles more than 2,000 activities and 3,000 relations. Produces a variety of reports to show distribution of resources over the project life or on a month-to-month basis. Tables and bar charts include information derived from many sorting criteria.

659 TIME-PLAN

Mitchell Management Systems, Inc., Westborough Office Park, 2000 West Park Drive, Westborough, Mass. 01581—R. B. Daluga, 617-366-0800 • For use with Data General Desk Top, DEC Rainbow Plus, HP 150, IBM PC-XT, IBM compatibles and Wang PC • Price: $149; Updates: billable • Training: seminar, in-house and manual.

Time-Plan is a network-based, critical path method decision-support tool for personal computers. *Time-Plan* permits users to structure time information in network format, allowing managers to evaluate the impact of alternative plans and schedules.

660 TIMEKEEPER

EMA Management Associates, Inc., 1145 Gaskins Rd., Richmond, Va. 23233—Terri C. Connell, 804-740-8332 • For use with TRS-80 Model 3 or 4, two disk drives and an 80-character printer or larger • Price: $395; Updates: free • Training: manual and computer-aided instruction.

Timekeeper posts hours to project by employee and phase. Monitors hours remaining in project budget, percent spent for all phases of all projects, overhead cost, employee vacation, holiday and sick leave. Data is input through a fill-in-the-blank format.

661 TOPMAN PROJECT MANAGEMENT SYSTEM

Applied Management Methods, Inc., 201 N. Broad St., Doylestown, Pa. 18901—Robert J. McGrody, 215-348-1200 • For use with PDP-11/34, VAX 730 & up, CALCOMP-compatible printer, VT 100 CRT; requires 128k RAM • Price: $20-30,000; leasing available from $1000 per month; Updates: billable • Training: in-house, on-site at cost, manual, computer-aided instruction.

Topman Project Management System generates bar charts, graphic plots and printer reports to reflect work achieved in activities, probable completion dates, critical path, resources expended, dollars required to complete, and exception reporting. Reports are available for project division, sub-division, or multi-project networking.

662 VUE

National Information Systems, Inc., 20370 Town Center Lane, Suite 130, Cupertino, Calif. 95014—Cheryl Smith, 408-257-7700 • For use with DEC-10 or 20, VAX, PDP-11, HP 3000, Perkin Elmer 3200 series or Honeywell DPS-6/8 • Price: $16,000—$26,000 on perpetual license; Updates: no charge during first 6 months; billable at 10 per cent of license fee thereafter • Training: in-house, on-site or manual.

Vue is an interactive project management system that uses the critical path method to spot activities whose timely completion is critical to finishing the project on schedule. Tracks up to 3,000 activities. Options are graphics, time-scaled network diagram, multi-project capabilities and a custom report writer module. Also available on timesharing.

4 Space planning and facilities management

668 ARCHITECT'S FRIEND—V1.1
Team Design, 5290 N. Picket Dr., Colorado Springs, Colo. 80907—Bob Moore, 303-598-0663 • Program operates as part of a turnkey system or with IBM PC and compatible computers running MS-DOS. Peripherals include PGS MAX-12 and Color Graphics XL-19 monitors, Houston Instruments DMP-52 plotter, SAC Sonic digitizer and NEC P-3 printer • Price: from $2,895 for software; $27,995 for turnkey package; Updates: free; modem option • Training: in-house, on-site, manual, computer-aided instruction and video-training cassettes.

Architect's Friend—V1.1 is an integrated graphics-based applications package that includes project management, energy analysis, full accounting, floor plans, elevations, renderings and development planning. The program is written in "C" language for transportability and uses a standard file management database.

669 ARCHITECTURAL COMPUTERIZED DRAFTING SERVICES, SYSTEM RENTAL AND SYSTEM SALES
NPS Automation Services, Inc., 202 Johnson Rd., Morris Plains, N. J. 07950—Paul Zeman, President 201-455-1311 • Software available unbundled, as part of turnkey system and through service bureau and timesharing; no hardware required for services or system rental; for system purchase, hardware and peripheral requirements depend on application and processing volume • Price: depends on configuration; Updates: free with service/maintenance contract • Training: seminar, in-house, on-site and computer-aided instruction.

Architectural Computerized Drafting Services, System Rental and System Sales permits the creation of complete overlay floor layouts with any requested information—furniture, partions, electrical, hvac etc. Uses standard symbology to create current bill of materials. Also produces charts and graphs, stacking plans, and block diagrams.

670 FACILITIES MANAGEMENT PACKAGE
Computervision Corporation, 100 Crosby Drive, Bedford, Mass. 01730—Ben Smith, 617-275-1800 • Software is available only as part of a turnkey package, which incorporates Computervision CDS 4000 equipment • Price: N/A; Updates: billable or included with maintenance contract • Training: in-

house, manual and computer-aided instruction.

Facilities Management Package addresses the multi-discipline needs of the facilities management team from site preparation, structural design, and building systems through architectural modeling and presentation. Provides for on-going management of industrial or commercial facilities by including report-generation function with space-attribute management capabilities.

671 FACILITY MANAGER
Vivid Software Corp., 900 Lafayette St., Suite 604, Santa Clara, Calif. 95050—Shirley McMillan, 408-241-1921 • For use with IBM PC or compatibles • Price: $1,200; Updates: billable • Training: manual.

Facility Manager keeps track of all partitions and hang-on components by department number, building area and square footage. Square footage can be net or gross. Permits day-to-day management of workstations, projections and "what-ifs."

672 FACILITY PERSONNEL/SPACE REQUIREMENTS
ACCI Business Systems, Inc., 4625 N. Freeway, Suite 200, Houston, Texas 77022—Paul Pamer, 713-697-3566 • For use with microcomputers running MS-DOS or CP/M; requires 64k RAM • Price: $1,500; Updates: billable • Training: manual.

Facility Personnel/Space collects, updates and reports data related to space requirements for architectural and space planning purposes. Allows users to describe a company's organizational structure, project personnel and non-people space requirements, and, also, develop and model corporate space standards to be used for design of office and open-plan space.

673 FAMES
Decision Graphics, Inc., 11 Main St., P. O. Box 306, Southborough, Mass.01772—John Nilsson, 617-481-4119 • For use with any VAX/VMS system; peripherals are W-4109 or W-4115 graphic workstation • Price: $5,000-$16,000; Updates: billable • Training: on-site and manual.

Fames is an interactive graphics package that enables users to enter, store and report on all space in a facility. Each space can have many attributes associated with it, for example, name, department, space-type and telephone. Space is grouped in a hierarchy to allow the

usual roll-up of data such as a company, group, department, room and area. Generates high-quality plots.

674 LAYOUT: FACILITY LAYOUT DESIGN SYSTEM
Auto-trol Technology, 12500 N. Washington St., P. O. Box 33815, Denver, Colo. 80233—Thomas C. Curry, 303-452-4919 • For use with Advanced Graphic Workstation-Apollo-based; Supports HP, Calcomp or Versatec plotters, Seiko, TI and Tektronix hard copy • Price:$3,500; Updates: free • Training: seminar, in-house, on-site and manual.

Layout is a graphics software program that can build typical workstations and produce both schematic and detailed layouts for interiors.

675 MANAGER
Auto-trol Technology, 12500 N. Washington St., P. O. Box 33815, Denver, Colo. 80233—Thomas C. Curry, 303-452-4919 • For use with Advanced Graphic Workstation-Apollo-based; Supports HP, Calcomp or Versatec plotters, Seiko, TI and Tektronix hard copy • Price: $71,000; Updates: free • Training: seminar, in-house, on-site and manual.

Manager consists of three modules that assist in the management of corporate assets. The forecast module translates business strategies and forecasts into physical space requirements. The Space Planning Module creates stack plans, block plans and affinity/adjacency studies. The Facilities Manager module assists in managing personnel and physical resources.

676 MODULAR COMPUTERIZED MAINTENANCE MANAGEMENT PROGRAM
Sigma Consulting Group, 12465 Lewis St., Suite 104, Garden Grove, Calif. 92640—John H. Self, 714-971-9964 • For use with any microcomputer running the PICK operating system; requires a 10mb hard disk • Price: $10,000— $40,000 depending on number of modules purchased; Updates: free during first year; included with maintenance plan thereafter • Training: in-house, on-site, manual and computer-aided instruction.

Modular Computerized Maintenance Management Program is a time, interactive, integrated database management program for facility and plant equipment maintenance Modules

include work order control, equipment history, preventative maintenance parts-inventory control, cost and management-information reporting.

677 SABA-STACKING AND BLOCKING ALGORITHMS
The Computer-Aided Design Group, 2407 Main St., Santa Monica, Calif. 90405—Tom Kvan, 213-392-4183 • For use with DEC-VAX or PDP 11/23, or IBM 30xx/43xx; requires 64k RAM • Price: $14,500 one-time license fee; Updates: free for first year, included with maintenance fee thereafter • Training: seminar, in-house, on-site and manual.

Saba generates schematic stacking and blocking plans in such a way that highly interrelated activities are placed in adjacent zones and circulation/communications costs are minimized. Produces any number of reports to define a client's program and help translate it into a schematic design solution.

678 SPACE PLANNING AND FACILITIES MANAGEMENT
Micro-Vector, Inc., 111 Bedford Rd., Armonk, N.Y. 10504—Judith Ulrich, 914-273-8700 • For use with IBM PC-XT and Hewlett Packard 250; requires printer and graphics cards • Price: $5,000 per module; Updates: billable or included with service/maintenance contract; consulting and customization available • Training: seminar, in-house, on-site, manual and computer-aided instruction.

Space Planning and Facilities Management is a program comprising five modules—projections, furniture, master, lease, stack and project budget—which aids in modeling space assignments and projections, building alternatives, furniture budgets and over-all project budgets. Develops space and facilities plans. Manipulates graphics and statistics. Single data base.

679 SPACE PLANNING/FACILITY MANAGEMENT
Intergraph Corporation, One Madison Industrial Park, Huntsville, Ala. 35807—Al Kemper, 205-772-2000 • A basic turnkey system consists of one computer workstation, hard printer, plotter and software. Systems are based on DEC-VAX and PDP-11 computers • Price: Turnkey package with software starts at $120,000; Updates: free with service/maintenance contract or billable • Training: in-house, on-site implementation plan; computer-aided instruction and manual.

Space Planning/Facility software is used to develop the layout drawings and management reports that contain the information needed for planning the most expeditious use of space and equipment. The software draws from an electronic catalog of furniture and equipment to produce detailed layout plans and reports. Further, the data created during space planning establishes an "as-installed" database useful for leasing studies, depreciating equipment and other facility management tasks.

680 TOTAL FACILITIES MANAGEMENT SYSTEM

Resource Dynamics Inc., 118 Great Rd., Stowe, Mass. 01775—Ross Trenholm, 617-897-6350 • Turnkey system consists of Masscomp CPU, 1mb processor memory, 50mb disk storage, Hitachi digitizer, color workstation/CRT, line printer, ink-jet printer and optional D- or E-size plotter • Price: $150,000— $175,000 for basic system; Updates: included with maintenance program • Training: seminar, in-house, on-site, manual and menu-driven commands.

Total Facilities Management System is a management information system that integrates facilities planning with corporate and organizational planning. Allows programming for present and future space requirements, tracks current space utilization, generates color building stacking diagrams, block-type floor plans, business graphics and full reports.

681 UNI-USER NEEDS INFORMATION

The Computer-Aided Design Group, 2407 Main St., Santa Monica, Calif. 90405—Tom Kvan, 213-392-4183 • For use with DEC-VAX or PDP-11/23; requires 500K RAM • Price: $19,500 one-time license fee; Updates: free for first year, included with maintenance fee thereafter • Training: seminar, in-house, on-site and manual.

UNI—User Needs Information is used during programming to collect and manage information about personnel, equipment and space-requirement projections, special characteristics of items within a space program and adjacency data for groups. Data can be read by the *Stacking and Blocking Algorithms* program (*SABA*) also available from The Computer-Aided Design Group (see 677 above).

685 ACDS 7000

ACDS Graphic Systems Inc., 100 Rue Edmonton St., Suite 232, Hull, Quebec J8Y 6N2—Dave Strutt 819-770-9631 • Turnkey system consists of 32-bit super micro, 1.5mb RAM, 35mb disk storage (expandable) dual-screen workstation, Bit Pad digitizer, keyboard and word processing software; plotter not included • Price: $25,000 to $50,000; optional software modules: *HUB*—$16,000, *Lattice*—$8,000, *DBMS*—$8,000, *User Extensibility Environment*—$16,000; Updates: included with service and maintenance contract or billable • Training: seminars, on-site, in-house and manual.

ACDS 7000 is an interactive turnkey drafting and design system assembled around a 32-bit super microcomputer that can support up to six workstations. Four modules available for the system provide varying capabilities: Features of *HUB*, the two-dimensional design and drafting module, are area calculations, floor-plan generation, symbols library, bill of materials and scheduler, site plans, urban planning and road layout. The *Lattice* module is a three-dimensional surface modeling package with walk-thrus and hidden-line and surface removal. *DEMS* module is a network database management system with a query language for specs, take-offs, schedules, reports and structural analysis. *User Extensibility Environment* is a run-time macro generator for creating personalized applications.

686 ADS-II ARCHITECTURAL DRAFTING SYSTEM

Design Data Systems Corp., 5270 N. Park Place, N.E., Cedar Rapids, Iowa 52402—F. J. Krause 319-373-1571 • For use with HP 9836C computer workstations, HP 7580, 7585 and 7586 plotters, HP 9111A digitizer, HP 9133XV Winchester, and optional graphics printer • Price: $10,000—includes three symbols libraries; Updates: free during first year; billable thereafter • Training: in-house, on-site, manual or telephone support.

ADS-II Architectural Drafting System is a two-dimensional drafting system with capabilities that include site plans produced from legal descriptions, topography plots created from survey data, bubble/flow diagrams, and working drawings. Added features are mirror imaging, stretch, on-screen calculator, and on-screen composition of plotter layout.

687 A/E CADD 200

ECOM, 8634 West Brown Deer Rd., Milwaukee, Wisc. 53224—Ellen Henson, 414-354-0243 • For use with HP series 200 computers and peripherals • Price: from $32,300 for turnkey system; *ECOM* software modules $1,000; Updates: billable • Training: 8 hours of on-site training free; billable thereafter; manual, in-house.

A/E CADD 200 is a two-dimensional drafting package built around HP EGS-200 Graphics Editor enhanced with any combination of three customized modules: architectural with standard details; office planning and layout; and structural with standard details.

688 ARBASE

SKOK Systems Inc., 222 Third St., Cambridge, Mass. 02142—Steve O'Neill, 617-868-6003 • For use with Artech Datastation comprising HP 9816 CPU, Pascal o/s, 750k RAM memory, 9 in. monochrome screen and keyboard; range of disk options and networking available • Price: $10,000; discounts available for multiple purchases; Updates: included with service/maintenance contract • Training: seminar, in-house, on-site and manual.

ARBASE is a fully relational database integrated to the *ARPLAN* software (see 695 below) with sophisticated data entry, organizational and reporting capabilities. Usable for project management, facilities management, office and project cost control and accounting. *ARBASE* can be used on the Artech Designstation and lower cost Artech Datastation.

689 ARCADE 2

BruningCAD, 6111 E. Skelly Dr., Tulsa, Okla. 74135—William F. Albu, 918-663-5291 • Turnkey system consists of MC 68000-based processor, 1.9mb RAM, 14.5mb Winchester hard disk, dual 3 1/2-in. floppy drives, 19-in. raster display with articulated mounting arm, 3-button optical mouse, full modular keyboard, Thermal Graphics printer and D-size plotter • Price: $49,795; Updates: offered as part of comprehensive support package for 1 per cent of system price per month • Training: on-site.

Arcade 2 is a drafting and design system incorporating such automatic features as drawing with walls, bands, and using levels or overlays. Optional software modules include *AttriBase*, an attributive database that incorporates an interactive spread sheet and bill-of-materials capabilites, and *Arcade 3*, a three-dimensional wire-frame version.

690 ARCHITECT'S FRIEND—V1.1

Team Design, 5290 North Picket Dr., Colorado Springs, Colo. 80907—Robert L. Moore, 303-598-0663 • Program operates as part of a turnkey system or with IBM PC and compatible computers running MS-DOS. Peripherals include PGS MAX-12 and Color Graphics XL-19 monitors, Houston Instruments DMP-52 plotter, SAC Sonic digitizer and NEC P-3 printer • Price: from $2,895 for software; $27,995 for turnkey package; Updates: free; modem option • Training: in-house, on-site, manual, computer-aided instruction and video-training cassettes.

Architect's Friend—V1.1 is an integrated graphics-based applications package that includes project management, energy analysis, full cost and general accounting, word processing, spec writing, floor plans, elevations, renderings and development planning. Developed in concert with architects and written in "C" language for transportability. Uses a standard file management database.

691 ARCHITECTURAL INTERACTIVE DESIGN SYSTEM

ARCAD, 445 South Figueroa St., Los Angeles, Calif. 90071—Peter H. Martin, 213-627-1427 • For use with VAX 11/780, 11/750, 11/730, 11/725; Textronix 4000-series terminals; Versatec, Calcomp and HP plotters • Price: $7,000 for one workstation; $14,000 thereafter; turnkey package available for $60,000; Updates: billable • Training: manual and telephone support.

Architectural Interactive Design System performs computerized design and production drafting, providing three-dimensional solids modeling, "walk arounds" in full color, symbols and detail library, line-weight control, pattern-fill and automatic dimensioning. Sixty-day evaluation period at cost.

692 ARCHITECTURAL PRODUCTION DRAWINGS

Intergraph Corporation, One Madison Industrial Park, Huntsville, Ala. 35807—Al Kemper, 205-772-2000 • A basic turnkey

system consists of one computer workstation, hard printer, plotter and software. Systems are based on DEC-VAX and PDP-11 computers • Price: Turnkey package with software starts at $120,000; Updates: free with service/maintenance contract • Training: in-house, on-site implementation plan, computer-aided instruction and manual.

Architectural Production Drawings develops elevations, sections, details and reflected ceiling plans. All drawings are automatically dimensioned at the desired scale. Project specifications associated with the drawings and stored in the DMRS database (included in the basic turnkey package) are readily extracted and printed out as complete door and finish schedules.

693 ARCHITECTURE PACKAGE

Computervision Corporation, 100 Crosby Dr., Bedford, Mass. 01730—Ben Smith, 617-275-1800 • Software is available only as part of a turnkey package which incorporates Computervision CDS 4000 equipment • Price: Not available; Updates: billable or included with maintenance contract • Training: in-house, manual and computer-aided instruction.

Architecture Package permits the creation and presentation of architectural building models and contract drawings and accompanying reports and schedules of non-graphic architectural information. Designed for all architectural applications and as a basis for the *Building Engineering, Civil/Structural Engineering,* and *Civil/Site Engineering* packages that work in conjunction with the *Architecture Package.*

694 ARMAC

SKOK Systems Inc., 222 Third St., Cambridge, Mass. 02142—Steve O'Neill, 617-868-6003 • For use with Artech Designstation or Datastation • Price: $5,000; Updates: included with service/maintenance contract • Training: seminar, in-house, on-site and manual.

ARMAC is a macro-language system which allows the user to write special purpose graphics routines in *ARPLAN.* The routines are combinations of graphics primitives which may include

calculations and data transfer to the *ARBASE* relational database product (see 688 and 695).

695 ARPLAN

SKOK Systems Inc., 222 Third St., Cambridge, Mass. 02142—Steve O'Neill, 617-868-6003 • For use with Artech Designstation comprising HP 9920 CPU, Basic 3.0 o/s, 2mb RAM memory. 19-in. color screen, menu tablet with stylus and keyboard; graphics processor upgrade including 1mb RAM • Price: $17,500; discounts available for multiple purchases; Updates: included with service/maintenance contract • Training: in-house, on-site, manual and seminar.

ARPLAN is a two-dimensional design and drafting system. Among capabilities are layering, colors, symbol and pattern libraries, global editing and a feature called block stretch, which permits designers to stretch and shrink elements in a schematic diagram without concern for dimensional accuracy. *ARPLAN* also draws the parallel lines of walls to specified thickness and automatically cuts off and seals their ends.

696 ARPLOT

SKOK Systems Inc., 222 Third St., Cambridge, Mass. 02142—Steve O'Neill, 617-868-6003 • For use with Plotting Station comprising HP D- or E-size pen plotters and Artech Datastation (see 688) • Price: $1,500; Updates: included with service/maintenance contract • Training: seminar, in-house, on-site and manual.

ARPLOT is an off-line plotting product which allows files to be plotted independently of the Artech Designstation. A low cost Artech Datastation is used to run this system which may also be used to run *ARBASE* and *ARMAC.* In a networked configuration, no additional disk storage is required to allow this system to operate.

697 ARTEC 1

Go Fukai, P. O. Box 330040, San Francisco, Calif. 94133—Dennis Fukai, 415-362-1424 • For use with Macintosh and Lisa with optical or laser printer; requires 128k RAM; hard disk recommended • Price: $1,300/yr. license; Updates: billable • Training: on-site and computer-aided instruction.

ARTEC 1 offers interactive design decisions referenced in a pixel-based CAD system. The program demonstrates preliminary specification and graphic relationships while displaying cost feasibility parameters for immediate evaluation. Features full screen draw, memo and editing.

698 ARTEC 2

Go Fukai, P. O. Box 330040, San Francisco, Calif. 94133—Dennis Fukai, 415-362-1424 • For use with Macintosh and Lisa with optical or laser printer; requires 512k RAM; hard disk recommended • Price: $1,800/yr. license; Updates: billable • Training: on-site and computer-aided instruction.

Artec 2 generates contract documents through refinement of initial design concepts established in *Artec 1.* Permits continuous interaction between cost and graphic relationships, establishing a format for construction drawings that relate three-dimensional volumes inherent in the design. Specifications and detailing are interfaced in the printed output.

699 ARVIEW

SKOK Systems Inc., 222 Third St., Cambridge, Mass. 02142—Steve O'Neill, 617-868-6003 • For use with Artech Designstation comprising HP 9920 CPU, Basic 3.0 o/s, 2mb RAM memory, 19-in. color screen, menu tablet with stylus and keyboard; graphics processor upgrade including 1mb RAM • Price: $7,500; discounts available for multiple purchases; Updates: included with service/maintenance contract • Training: in-house, on-site, manual and seminar.

ARVIEW is an add-on product to *ARPLAN* that allows the user to define the third dimension for all items in a two-dimensional file. The resulting forms may then be viewed and evaluated as three-dimensional representations in wire-frame or as surface shaded models. With the Graphics Processor option installed in the Artech Designstation, real-time manipulation and viewing of the model is available.

700 ASP STAIR PROGRAM

Architectural Software Products, Inc., 13974 Westheimer, Suite 200, Houston, Texas 77077—James D. Noble, 713-531-8533 • For use with Integraph computers with virtual memory system • Price: $5,000; Updates: free • Training: manual.

ASP Stair Program builds a design file containing fully dimensioned plan and section views of the exit-stair design from design and display parameters specified by the user in an interactive interrogatory conducted in an off-

line mode at an alpha-numeric terminal. Once specified, the program executes automatically in two to three minutes. Included with the program is a set of typical details that can be modified by the user.

701 AUTOCAD

AutoDesk, Inc., 150 Shoreline Highway, Building B, Mill Valley, Calif. 94941—Jennifer Newman, 415-331-0356 • For use with IBM PC, Victor 9000, Zenith, NEC, DEC, Eagle and Texas Instruments microcomputers; requires MS-DOS, PC-DOS or CP/M operating systems, keyboard, digitizer, touchpen or stylus, plotter or printer and 256k RAM min. • Price: $1,500; Updates: billable • Training: on-site and manual.

AUTOCAD is a menu-driven two-dimensional program for producing schematics and working drawings. Users may create screen menus via ordinary text files, define parts libraries and interactively create and edit drawings of any size and scale. An optional drafting package features dimensioning, cross hatch/pattern fill, fillets, partial delete and a units-command for both dimensions and coordinates in feet and inches. *AUTOCAD*-to-Integraph translator permits graphics transfer between systems.

702 AUTOCAD/INTERGRAPH TRANSLATOR

Interactive Graphics, 1479 Chain Bridge Rd., McLean, Va. 22101—Brian Chavis, 703-556-0910 • For use with Intergraph CAD system and AUTOCAD microcomputer CAD system • Price: $10,000; Updates: billable • Training: seminars, in-house and manual.

AUTOCAD/Intergraph Translator is a system that translates AUTOCAD microcomputer drawings to Intergraph mainframe drawings (and Intergraph to AUTOCAD) permitting use of microcomputer workstations by architects and designers.

703 AUTOPLAN

Automated Design, P. O. Box 507, Valley Forge, Pa. 19481—Roberta C. Carnwath, 215-935-2420 • For use with Commodore 8032 computer, 8050 disk drive and Western Graphtec plotter • Price: $3,500 per workstation for turnkey system; $995 for software only; Updates: free • Training: manual.

AUTOPLAN is a two-dimensional drafting system that displays inputs instantaneously on a plotter.

5 Computer-aided design and drafting

Details, plans, layouts and text can be saved and combined with standard details, plans, overlays, title blocks, logos and dimensions previously on file.

704 AYCAD
Aydin Controls, 414 Commerce Dr., Ft. Washington, Pa. 19034—Ron Schlie, 215-542-7800 • Turnkey system consists of Aydin Controls multiple microprocessor CPU, 21mb Winchester disk drive, 1.2mb floppy disk drive, 1mb main memory, 13-in. and 19-in (color) monitors, 12- by 12-in. digitizing tablet, ASCII keyboard and software • Price: $47,500; Updates: included as part of license fee • Training: in-house, on-site.

AYCAD turnkey system is a two- and three-dimensional (wire-frame) design and drafting system for schematics, other preliminary design documents and working drawings. Also performs word processing and structural analysis.

705 BUILDING DESIGN SYSTEM (BDS)
McDonnell Douglas Automation Company (McAuto), Box 516, St. Louis, Mo. 63166, Marketing Services, 800-325-1551 • For use with Prime 2250, 2550, 9650, 9750, 9950; DEC-VAX Micro, 11/750, 11/780; Calcomp, HP plotters; Tektronix terminals, Tektronix hard copy units; requires 500k RAM • Available as part of turnkey package or software license • price of turnkey system from $68,000; Updates available • Training in-house.

Building Design System (BDS) is a three-dimensional computer graphics system for designing and modeling buildings. It has been developed by architects, engineers, and planners and is meant to be used by such. *BDS* follows the logical sequence of architectural design from programming to schematic design, design development, and construction documentation and is fully compatible with the General Drafting System (GDS) listed below (see 742).

706 CABINET PLANNER
Pattern Systems of NJ, 1259 Rte. 46, Bldg., Suite 2, Parsippany, N. J. 07054—Robert Gowen, 201-335-7804 • For use with IBM PC-XT running MS-DOS and a printer • Price: $4,995;

Updates: included with service/maintenance contract • Training: on-site and manual.

Cabinet Planner is used by custom or semi-custom cabinet or furniture manufacturers to totally solve the problems of job quoting, order taking, and production scheduling. Utilizing a formula-driven bill of material, the system calculates dimensions, quantities and costs of parts required to complete a job. (See also 725 below.)

707 CAD 10
Sumicom, Inc., 17862 E. 17th St., Tustin, Calif. 92680—Paul Kam, 714-730-6061 • Turnkey package consists of SUMICOM System 830 exclusively; uses CP/M-80 operating system and Houston Instruments DMP series plotter; System 830 has built-in, dot matrix bi-directional, correspondence-quality printer. Also features 8-color, 640 by 400 pixel screen and 10 function keys and 8 edit keys • Price: $4,590 including software; Updates: not available • Training: manual and in-house-software/hardware support.

CAD 10 program draws diagrams, schematics, floor plans and easily transposes them to paper. User can draw symbols, transcribe them into perfectly scaled drawings with editing, updating and reorganizing capabilities. Alignment grid with submenu enables design or copy of any symbol ten times the size of the actual drawing. *CAD 10* utility program includes the *Caduty Auxiliary Program*, permitting assembly of individual symbols or entire sets of symbols.

708 CAD-1
Chessel-Robocom Corporation, 111 Pheasant Run, Newtown, Pa. 18940—Peter Kendall, 215-968-4422 • For use with Apple II or Apple IIe; requires two disk drives, controller, super serial card and male-to-male RS-232-C cable; recommended plotter is HP 7470; 3-axis joystick controller supplied with software • Price: $1,095; Updates: billable • Training: manual.

CAD-1 is a menu driven two-dimensional drafting and graphics system with color capabilities and symbols libraries for producing schematics, flow charts and simple scale drawings on up to a D-size plotter. Joystick controller supplied with software is both a drawing instrument and menu-function selector. Turnkey workstation packages available.

709 CAD-2
Chessel-Robocom Corporation, 111 Pheasant Run, Newtown, Pa. 18940—Peter Kendall, 215-968-4422 • For use with Apple II or Apple IIe; requires 128k RAM • Price: $1,790 includes 128k RAM board, precision controller, interface module, library disk and tutorial documentation; Updates: billable • Training: manual.

CAD-2 is a more powerful version of *CAD-1*, enhanced with automatic dimensioning and numerical data entry.

710 CADDRAFT MINDSET
Personal CAD Systems Inc., 981 University Ave., Los Gatos, Calif. 95030—Tereze Hanley, 800-858-6384 • For use with Mindset computer, requires 256k RAM; two floppy disk drives, mouse, and HP 7470 or 7475 plotter • Price: $495 for software only; available as package with CPU and software but no plotter for $4,000; Updates: first update free, then billable • Training: seminar, in-house, on-site, manual, on-line help files

CADDRAFT is an easy-to-use, entry-level menu-driven package for creating editing, and plotting two-dimensional designs; and data on up to seven layers. Mindset computer offers 16 colors and high-quality graphics, which may be viewed individually or in combination with other layers.

711 CADKEY
Micro Control Systems, Inc., 27 Hartford Turnpike, Vernon, Conn. 06066—Helen Charov, 203-647-0220 • For use with IBM PC or compatible microcomputers; requires 384k RAM, one 320k floppy disk drive, color graphics adaptor card, graphics monitor, 2-D/3-D digitizer or mouse and a pen plotter or dot matrix printer • Price: $1,495; Updates: billable • Training: seminar, in-house, on-site, manual and computer-aided instruction.

CADKEY is an interactive two- and three-dimensional design and drafting system with primary applications that include mechanical design, detailed drafting, architectural engineering and schematics. Functions include automatic dimensioning, hidden-line removal, 3-dimensional transforms, fillets and chamfers. Command structure can be modified to resemble many larger CAD/CAM system command-formats.

712 CADLIB
The Cadlab, 1708 13th St., Boulder, Colo. 80302—Nelson Greene, 303-440-0228 • The Cadlab is a service bureau utilizing VAX-family computers • Price: per-project-basis;

Updates: not applicable • Training: on-site training arranged for firms wishing to utilize software under timesharing.

CADLIB is a collection of over 40 interactive two- and three-dimensional graphics programs used to model the SD and DD phases of the design process. Wireframe or hidden-line removed perspectives, axonometrics, plans, elevations and sections are typically output to screens, plotters and film recorders. Input programs are capable of defining separate components of a project for a variety of purposes including color, line-style and pen-type assignments, as well as visibility and invisibility. Component changes are accommodated by simple delete/insert commands. The collection is especially suitable for large-scale projects requiring any type of visual assessment or client communication such as: view corridor analysis, massing/form/scale issues, visual privacy issues, view sequence, spatial evaluation, sketch and rendering base drawings, solar access evaluation, spatial impact of vegetation growth, signage and interiors.

713 CADPLAN
Personal CAD Systems, Inc., 981 University Ave., Los Gatos, Calif. 95030—Tereze Hanley, 800-858-6384 • For use with IBM PC-XT or compatible computers, 320k RAM, 320k disk drive, 10mb hard disk drive, color monitor, IBM color graphics card, mouse or digitizer. • Price: $1900; Updates available • Training: seminar, in-house, on-site, manual, on-line help files •

CADPLAN is a two-dimensional drafting system for schematics, design development, and production drawings. Includes walls with automatic intersection detailing, automatic door and window insertion, dimensioning, database extraction, texturing, mirroring, splines, and extensive system libraries. For architecture; hvac, electrical, plumbing, and rendering. Supports high-resolution color and most peripherals.

714 CADVANTAGE
Haworth, One Haworth Center, Holland, Mich. 49423—Kris Ward, 616-392-5961 • For use with IBM PC-XT with 128k RAM, color graphics adapter board, Hayes

1200b external modem, Toshiba P1340 printer, HP 7475A plotter and Mouse Systems optical mouse • Price: $19,500 for turnkey system; Updates: billable at $500 per year • Training: expenses-paid four-day seminar at Haworth Center provided with turnkey package.

CADVANTAGE is Haworth's computer-aided design and drafting software and furniture library built around a turnkey IBM PC. The system allows access to the entire Haworth product/price catalog and also offers the user color graphics, cost quotation, records management and project report capabilities. Designers have the option of drawing upon the Haworth database or creating their own database.

715 CASCADE I
Cascade Graphics Development, 1000 S. Grand Ave., Santa Ana, Calif. 92705—Ken Barney, 714-558-3316 • For use with IBM PC with graphics card, Apple IIe/II+; requires two disk drives and monochrome monitor; input: joystick, koala pad or Summagraphics tablet; output: Houston Instruments DMP plotters, HP plotters, Epson, MPI printers • Price: $895 for Apple, $1,680 for IBM; Updates: billable • Training: manual.

CASCADE I computer-aided-design system performs the basic tasks found in larger systems such as lines, arcs, circles, ellipses, text, zoom-in for enlarging, zoom-out for reducing, move, copy, delete, axis lock, non-axis lock, grid pick, free pick, layering, automatic dimensioning, automatic crosshatching, rotate, scale, pan and groups.

716 CASCADE II
Cascade Graphics Development, 1000 S. Grand Ave., Santa Ana, Calif. 92705—Ken Barney, 714-558-3316 • Turnkey package utilizes Apple IIe with 128k RAM, 5mb hard disk, 5 1/4 in. floppy disk drive, monochrome monitor; input: Summagraphics tablet; output: DMP plotters, HP plotters, Epson and MPI printers • Price: $14,000; Updates: billable or free with service/maintenance contract • Training: manual, in-house and seminar.

CASCADE II turnkey system is designed for two-dimensional graphics production using menu-driven drawing tasks to create fundamental primitives such as lines, arcs, text and combinations of these groups. Symbols can be created or chosen from available symbols libraries, enabling quick development of drawings. The system is fully compatible with *CASCADE V* and *CASCADE X*, permitting future upgrades.

717 CASCADE V
Cascade Graphics Development, 1000 S. Grand Ave., Santa Ana, Calif. 92705—Ken Barney, 714-558-3316 • Turnkey package utilizes computer with 128k RAM, 5mb hard disk, 5 1/4 in. floppy disk drive and monochrome monitor; input: Summagraphics tablet; output: DMP plotters, HP plotters, Epson and MPI printers • Price: $23,500; Updates: billable or free with service/maintenance contract • Training: in-house, seminar and manual.

CASCADE V is a menu-driven turnkey design and drafting system with five independent processors that operate such peripherals as keyboard, stylus and joystick. Zoom and pan feature enables a user to stretch, rotate and move objects. A database management system permits itemizing components in a drawing to produce a bill of materials.

718 CASCADE X
Cascade Graphics Development, 1000 S. Grand Ave., Santa Ana, Calif. 92705—Ken Barney, 714-558-3316 • Turnkey system consists of computer with 128k RAM (68000 Processor); dual high-resolution monochrome monitor displays; 5mb hard disk and 5 1/4 in. floppy drives; input: Summagraphics tablet; output: HI-DMP and HP plotters; Epson and MPI printers • Price: $29,850; Updates: billable or included with service/maintenance contract • Training: seminar, in-house and manual.

CASCADE X is a high-resolution (1024 by 798) design and drafting system with dual monitors that allow a user to view the menu on one screen and draw on the other. Strap-on package, the *Associate* enables users to add text to drawings and create double-line walls and floor plans with automatic cleanup of the corners. Also permits doors and windows of specified widths to be automatically created to scale and inserted into walls.

719 CCSI-PLOT
Cerritos Computer Services, Inc., 4320 Atlantic Ave., Suite 1, Long Beach, Calif. 90807—Catherine Martin, 213-595-8607 • For use with most minicomputers and mainframes with Fortran; compatible with many printers; requires 32k RAM • Price: $1,500-$1,950; Updates: billable • Training: manual.

CCSI-PLOT is a pen-plotter-compatible graphics software package for dot matrix printers. Allows the convenient use of a dot matrix printer as though it were an incremental x/y pen plotter. Calcomp and Versaplot compatible.

720 CEADS-CADD
Holguin, 5822 Cromo Dr., El Paso, Texas 79912—John Wiseman, 915-581-1171 • Turnkey packages are based on the following hardware: HP 1000 Models 65/66/26/27, Micro 26, Micro 27 and Micro 29; supports HP 7585 plotter, 2623 workstations and various digitzers and printers • Price: $67,000 to $138,000; Updates: included with service/maintenance contract or billable • Training: seminar, on-site and manual.

CEADS-CADD is a two-dimensional general purpose design and drafting system that can support up to 12 workstations. Software can be tailored for specific applications such as AEC, mechanical design, facilities management and others, with user-selectable parameters. Fourteen modules make up a complete system, including drawing creation, editing, plotting, digitizing, system manager, bill of materials and more (example: moving a door or window and proper wall terminations can occur automatically.)

721 CEADS-CASC
Holguin, 5822 Cromo Dr., El Paso, Texas 79912—John Wiseman, 915-581-1171 • Turnkey system incorporates HP 1000 Series computers (See 720 above) • Price: $20,000; Updates: included with service/maintenance contract • Training: seminar, on-site and manual.

CEADS-CASC is a self-contained software product, highly complementary to *CEADS-CADD*. It provides macro capability, allowing the user to generate families of parts/drawings from a single command sequence and then transfer them directly to *CEADS-CADD* drawing workspace. The program is essentially a programming language that the user writes in to construct a command sequence to describe or draw a given geometry.

722 CEADS-GMS
Holguin, 5822 Cromo Dr., El Paso, Texas 79912—John Wiseman, 915-581-1171 • Turnkey package incorporates HP 9000 Series 500 computers (See 720 above) • Price: $25,000 to $50,000; Updates: included with service/maintenance contract • Training: seminar, on-site and manual.

CEADS-GMS is a three-dimensional solids-modeling software product that can be integrated with Holguin's *CEADS-CADD* system. *CEADS-GMS* utilizes a command language and a versatile graphic sketching mode that will guide users in generating simple three-dimensional primitives, more complex shapes and intricate solids modeling.

723 CLM COGO
CLM/Systems, Inc., 3654 Gandy Blvd., Tampa, Fla. 33611—C. L. Miller, P. E., 813-831-7090 • For use with IBM PC-XT, Sage IV, TI Professional and Wang PC; Supports HP, HI, Calcomp and Numonics plotters; compatible digitizers are HI, Calcomp and Numonics; requires 512k RAM • Price: $4,950; Turnkey package also available for $25,000—includes 4 graphics terminals, D-size plotter, 20-in. x 20-in. digitizer and multi-mode printer; Updates: free • Training: seminar, in-house, on-site, manual and computer-aided instruction.

CLM COGO produces preliminary and final drawings for site planning, topography, grading, drainage, roads, and utilities. Generates preliminary and final cost estimates from a variety of schedules. Program options include a relational database, word processor and spreadsheet.

724 COLOR PALETTE
Intergraph Corporation, One Madison Industrial Park, Huntsville, Ala. 35807—Al Kemper, 205-772-2000 • A basic turnkey system consists of one computer workstation, hard printer, plotter and software and starts at $120,000 • Price: $10,000; Updates: free with service/maintenance contract or billable • Training: in-house, on-site implementation plan, computer-aided instruction and manual.

Computer-aided design and drafting

Color Palette permits users to select from among 16 million colors in painting the surfaces of a model, shading for perspectives and showing how a facility will look under different conditions.

725 CUT PLANNER
Pattern Systems of NJ, 1259 Rte. 46, Bldg., Suite 2, Parsippany, N. J. 07054—Robert Gowen, 201-335-7804 • For use with IBM PC • Price: from $695—$7,995; Updates: included with service/maintenance contract • Training: on-site and manual.

Cut Planner gives a description of available sheet inventory and a description of a set of rectangular parts to be cut from that inventory and then generates cutting layouts which minimize waste and cutting time. The program is parameter driven to handle the requirements of special types of material and cutting equipment. (See also 706 above.)

726 DESIGN BOARD 3D
Mega CADD, Inc., 419 Second Ave. S., Seattle, Wash. 98104—Rob Lebow, 206-623-6245 • For use with IBM PC-XT and compatibles; requires color graphics card, mathco-processor and mouse • Price: $750; Updates: billable • Training: manual.

Design Board 3D is a three-dimensional modeling package for the front-end conceptual and schematic design phases of an architectural/interior design/space planning project. With the software, users can create and modify designs in three dimensions, work with flat and free-form curved surfaces, design in plan and view simultaneously in perspective, remove hidden lines in one step and view and generate drawings in any orientation desirable.

727 DESIGN GRAPHIX
Hamilton HGL Software, 6 Pearl Court, Allendale, N. J. 07401—George E. Timmons, 800-631-0298 • For use with DEC-VAX, PRO 350 or PDP-11 • Price: complete turnkey systems from $38,000—software only from $7,000; Updates: billable • Training: one week in-house with turnkey system; manual, on-site and computer-aided instruction for software.

Design Graphix is a turnkey two- and three-dimensional stand-alone or multi-user design and drafting system. Typical features are menu or keyboard-driven data entry, snap, grid, pan, zoom and windows, concurrent plotting and database

exchange. Graphic and non-graphic files can be combined for performing item counts, take-offs, specifications and drawing notes.

728 DESIGN ORIENTED GRAPHICS SYSTEM
PAFEC Engineering Consultants, Inc., 5401 Kingston Pike, Suite 610, Knoxville, Tenn. 37919—Tom Baudry, 615-584-2117 • For use with most 32-bit computers including DEC-VAX, Apollo, Data General MV Series, Harris and Prime • Price: $20,000—$30,000; Updates: included with yearly maintenance • Training: seminar, in-house, on-site and manual.

Design Oriented Graphics System (DOGS) is a two- and three-dimensional drafting system available as a turnkey system or software only. The system includes standard architectural symbols, multiline wall sections, multiple overlays, English and metric units with architectural-style dimensioning and, among many other features, database analysis capabilities for cost estimating and bill of materials.

729 DESIGNER I
Orcatech, 1000 Morrison Dr., Ottawa, Ontario K2H 8K7—Mark Milinkovich, 613-726-1600 • Turnkey system consists of an ORCA 1000 CPU computer graphics workstation with 512k RAM and a 10mb hard disk, 19-in. high-resolution monochrome or color monitor, separate text monitor, keyboard with joystick and software • Price: $38,000 CDN monochrome; $47,000 CDN color; software only: $13,000; quantity discounts for additional workstations; Updates: billable • Training: on-site, seminars and manual.

Designer I is a two-dimensional drafting system for engineering and architecture. Specific applications-capabilities are electrical layout, space planning, general schematics and business graphics. Turnkey system comes with a Fortran compiler and a library of 200 Fortran-callable subroutines. Optional digitizing tablet and expandable memory.

730 DGS-2000
Data Automation, 10731 Treena St., Suite 106, San Diego, Calif. 92131—Rick Hackworth 619-695-0806 • For use with HP 9800- or 200-series

computers; supports digitizers including HP 9111A graphics tablet, Hipad digitizer and Houston Instruments Series 7000; plotters include any HP plotter, Calcomp drum plotter or HI DMP 41/42/51 or 52; requires 187k user RAM after boot-up • Price: $1,995 for base package—$5,000 includes architectural symbols and 40 hours on-site training; Updates: billable • Training: on-site, manual and hot line ($365 per year).

DGS-2000 is a menu-driven two-dimensional design and drafting system for preliminary and working drawings. Includes database organization, high-speed zoom and pan, move, rotate, scale, mirror, layering, splining and user-created or ANSI symbols library.

731 DIGITAL PAINTBRUSH SYSTEM
The Computer Colorworks, 3030 Bridgeway, Suite 201, Sausalito, Calif. 94965—Joseph Osborn, 415-331-3022 • For use with Apple IIe and II with 64k RAM and one or two disk drives • Price: $299; Updates: nominal charge • Training: manual and telephone support.

Digital Paintbrush System permits users to draw free-hand, create perfect lines, rectangles, circles and curves, trace and letter. Two users can draw simultaneously over the telephone via a modem. Other features are automatic "elastic" lines, rectangles and circles, smart-fill, selection of brush shapes, adjustable grids, libraries and choice of type fonts.

732 DIGITRAK
Chempro Data Sciences Corp., 507 Southampton Rd., Westfield, Mass. 01085—Norman St. Martin 413-562-2353 • For use with: IBM PC-XT, color or monochrome monitors, Digitrak sonic digitizer; supports most plotters • Price: $5,470; Updates: free for first year; billable thereafter • Training: seminars, in-house, on-site, computer-aided instruction, manual and telephone support.

DIGITRAK is a design and drafting system with applications including mechanical, lighting, hvac and energy/solar. Among capabilities are axis, grid, snap with rubber band, layering, line, circle, arc, fillet, change, copy, move, text erase and plot.

733 DIMENSION III
Calma Company, 2901 Tasman Dr., Santa Clara, Calif. 95050—T. Sherman, 408-748-9600 • Turnkey system based on the Data General 16-bit Eclipse, DEC 32-bit VAX, or 32-bit Apollo computers • Price: costs

vary depending on hardware and software configuration; Updates: billable • Training: seminar, in-house, on-site, manual and computer-aided instruction.

Dimension III is a core software system for design and drafting in architecture, engineering and construction that supports any of nearly a dozen specific application packages. These include two-dimensional architectural drafting, facilities layout, civil-site preparation and steel layout and design.

734 DRAWING PROCESSOR
BG Graphic Systems Inc., 824 Stetson Ave., Kent, Wash. 98031—R. F. Bousley 206-852-2736 • For use with IBM PC, PC-XT, Eagle PC-XL Plus, Eagle 1600, Compaq, Columbia, and DEC Rainbow; requires 256k RAM • Price: $995; Updates: billable • Training: manual.

Drawing Processor is a menu-driven two-dimensional drafting and technical illustration package for architects, designers, engineers and manufacturers. Edit capabilities include block move with rubberbanding (all lines move as a unit), block erase, block components (for repetitive placement), selective erasure, computer-assisted dimensioning, layering and differential scaling. External file can be output in ASCII. Optional file transfer utilities program costs $200.

735 EASY DIGIT
Omnitech, Inc., 50 Baltusrol Way, Short Hills, N. J. 07078—K. D. Steidley, Ph. D., 201-376-6406 • For use with IBM PC-XT or compatibles; requires color graphic board, 256k RAM, serial port, digitizer and Epsom printer; drawing size up to 6 by 8 ft • Price: $4,000—$5,000; Updates: handling charge • Training: manual.

Easy Digit permits acquisition and manipulation of two- or three-dimensional data from digitizers. Automatically calculates lengths and areas. Generates computer files and issues reports. Allows generation of three-dimensional perspectives when used with optional *Golden Software*.

For more information on any
software program, circle the item
number on special Reader Service
card following page 80

736 ENER GRAPHICS
Enertronics Research, Inc., 150
North Meramec, Suite 207, St.
Louis, Mo. 63105—Randy Andes,
800-325-0174 • For use with IBM PC
and compatible microcomputers,
graphics adaptor board, color
monitor and most dot matrix
printers and X/Y plotters; requires
128k RAM • Price: $350; Updates: at
cost • Training: on-site, in-house,
manual, seminars.

Ener Graphics is a two- and three-
dimensional program that
combines, into one package,
business graphics, statistical
analysis, drawing functions, word
processing, symbol and font
generation, presentations and three-
dimensional plotting of surfaces
and objects.

**737 ENGINEERING
PRODUCTION DRAWINGS**
Intergraph Corporation, One
Madison Industrial Park,
Huntsville, Ala. 35807—Al Kemper,
205-772-2000 • A basic turnkey
system consists of one computer
workstation, hard printer, plotter
and software. Systems are based on
DEC-VAX and PDP-11 computers •
Price: Turnkey package with
software starts at $120,000;
Updates: free with service/
maintenance contract • Training: in-
house, on-site implementation plan,
computer-aided instruction and
manual.

*Engineering Production
Drawings* software supports the
production of contract drawings,
schedules and bills of materials that
are required for bidding and
construction. The software
addresses hvac, plumbing,
structural and electrical design
activities. Additional capabilities are
available for civil-site design.
Because drawing elements are
linked to descriptive information,
specifications and bills of materials
are readily available for all or part
of a project.

**738 EUCLID/BUILDING
DESIGN**
Matra Datavision, Inc., 99 South
Bedford St., Burlington, Mass.
01803—Miguel Suarez, 617-229-2630
• For use with VAX/VMS or IBM
VM/CMS • Price: $75,000 for base
package; $7,500 for one access to a
workstation; $5,000 for Building
Design module; Updates: included
with maintenance agreement •
Training: in-house, on-site, manual
and computer-aided instruction.

Euclid/Building Design computer
software system performs solids
modeling, design, drafting, analysis,
numerical control output, database
management and flexible

visualization. The system is
optimized for architecture with a
"Building Design" module which
enables users to create various
types of models and then extract
formwork drawings, data for
structures computations and
quantities of parts or materials.

739 FORM:DRAW
Formative Technologies, Inc., 5001
Baum Blvd., Pittsburg, Pa. 15213—
Richard Hessdorfer, 412-682-8000 •
Form:Draw software forms the
heart of a stand-alone turnkey
system comprising a 16/32 bit-sliced
CPU, 10mb/sec. Ethernet local-area-
network, 19-in. high-resolution
black-and-white monitor,
alphanumeric keyboard, 3-button
mouse and 1mb main memory. •
Price: $69,500; additional software
modules priced at $5,000; Updates:
included with service/maintenance
contract • Training: on-site and
manual.

FORM:DRAW is a two-dimensional
turnkey drafting/design system
built upon two programs:
FORM:DRAW and
FORM:SKETCH. FORM:DRAW
features pull-down menus,
automatic vernier, rubberbanding,
associative dimensioning and
multiple-window
management.*FORM:SKETCH*, a
freehand sketcher, permits users to
select pen-styles and drawing
commands from on-screen menus
and then automatically draw lines
and circles, enter text, move copy
and "fill" sketched areas. Other
program modules are available for
scanning drawings, architectural
design and layout and facilities
management.

740 GDIG
Decision Graphics Inc., 11 Main St.,
P. O. Box 306, Southborough, Maine
01772—John Nilsson, 617-481-4119 •
For use with any VAX/VMS system;
peripherals: include W4109 or W4115
graphic workstation with ditizer D1,
D2 or D3 • Price: $5,000-$16,000;
Updates: billable • Training: on-site,
manual.

GDIG is a digitizing program for
fast, accurate input of existing
drawings. The program uses metric
or English units, any scale; and
commands from either keyboard or
digitizer. Some of the graphic
commands are: lines, rectangles,
circles, arcs, text, door symbols,
column strings and standard
symbols.

**741 GENERAL BUILDING
DESIGN**
Computervision Corporation, 100
Crosby Dr., Bedford, Mass. 01730—
Ben Smith, 617-275-1800 • Software

is available only as part of a
turnkey package which
incorporates Computervision CDS
4000 equipment • Updates: billable or
included with maintenance contract
• Training: in-house, manual and
computer-aided instruction.

General Bulding Design permits
the creation of production drawings
and accompanying reports and
schedules. Designed for
architecture, architectural
engineering, and facilities
management applications. Includes
keyfiles and libraries (templates,
textures, and line fonts).

**742 GENERAL DRAFTING
SYSTEM (GDS)**
McDonnell Douglas Automation
Company (McAuto), Box 516, St.
Louis, Mo. 63166, Marketing
Services (800) 325-1551 • For use
with Prime 2250, 2550, 9650, 9750, 9950;
DEC-VAX Micro, 11/750, 11/780; Calcomp,
HP plotters; Tektronix terminals,
Tektronix hard copy units; requires
500k RAM • Available as part of
turnkey package or software
license; • price of turnkey system
from $68,000; Updates available •
Training in-house.

General Drafting System (GDS) is
an extremely flexible and fully
interactive computer drafting
system designed to improve the
production drawing process. *GDS*
has been designed specifically for
architecture, engineering, facilities
management, and space planning.
The high productivity associated
with *GDS* is attributed to its many
user-oriented features. These
include Associative Data, Object
Intelligence, and an automatic
placement feature for graphics and
text called Hit Codes. GDS is fully
compatible with the *Building
Design System (BDS)* listed in 705
above.

743 GEOCAD
Rudolph Horowitz Associates
Architects, Laurel Rd., Pound
Ridge, N. Y. 10576—Rudolph
Horowitz, 914-764-4072 • Turnkey
system consists of NEC APC 16-bit
microcomputer with 384k RAM, 8-
color, 640 by 475 pixel screen, floppy
and 10mb hard disk drive,
detachable keyboard HI DMP-42
plotter and enhanced *AUTOCAD*
software • Price: $14,850; Updates:
free for first 90 days, billable
thereafter • Training: 15 hours on-
site training and telephone
consultation included.

GEOCAD utilizes *AUTOCAD*
software enhanced with a series of
graphic and macro routines
addressable from the digitizer pad,

which contain the basic
architectural symbols necessary to
produce architectural drawings.
Menus include Helvetica, floor-plan
fixture, partition, mechanical, site,
door and window, and furniture.

744 GOAL
Abacus c/o Constech Inc., 8615
Freeport Parkway, P. O. Box
610663. D. F.W. Airport, Texas
75261-0663—Paul Manweiler, 214-
257-1186 • For use with Plexus, DEC-
VAX, IBM, Burroughs and other
minis and mainframes; requires a
graphics terminal, 1mb RAM and
6mb disk storage • Price: $12,500;
Updates: free • Training: in-house
and manual.

Goal is a design modeling system
which performs detailed quantity
analysis, spacial planning,
functional-area analysis,
environmental analysis, annual
operating and life-cycle costs,
construction costing and lighting
analysis. *Goal* generates designs
and costs interactively and with
CADD graphics from either digitizer
or keyboard and permits a user to
model and remodel to achieve a
balanced and economical design.

745 GRAPHICS 3
Tricad, 1655 McCarthy Blvd.,
Milpitas, Calif. 95035—Mark
Helm, 408-942-8800 • Turnkey
system consists of DEC-VAX-11 Series
CPU, hard disk mass storage,
magnetic-tape transport, system
console, TRICAD intelligent
workstation with alphanumeric
display/keyboard, high-resolution
display, digitizing worksurface and
chair, choice of plotter, modem and
software • Price: $150,000—$250,000
depending on options; Updates:
issued three times yearly as part of
annual maintenance • Training: in-
house, on-site and manual with full
documentation.

Graphics 3 is an integrated CAD
system specifically designed for
architects, engineers and facilities

managers. A database called *Object* permits both graphic and non-graphic information to be stored and viewed throughout the design process. Applications include planning, drawing production, analysis and report writing. Main software modules build upon the core system, which is accessible for user-developed applications.

746 GRAPHICS EDITOR
Radian Corporation, 8501 Mo-Pac Blvd., Austin, Texas 78766—Carl Kurz, 713-686-8481 • For use with most mainframe computers; requires a plotter • Price: $23,000; Updates: included with service/maintenance contract • Training: seminars, in-house, manual, on-site and computer-aided instruction.

Graphics Editor is an interactive software product that permits the display and editing of images at a graphics terminal. The program interfaces with CPS-1 and CPS-1/G (see 815 and 816 below) to edit points, polylines, text and objects.

747 GRAPHICS TOOL KIT
Demco Electronics, 10516 Grevillea Ave., Inglewood, Calif. 90304—Darrell Hoblack, 213-677-0801 • For use with Apple II/Apple IIe; SHG-640 graphics board (provided with system) and Apple Mouse • Price: $495; Updates: small fee • Training: manual.

Graphics Tool Kit is a hardware/software package that instills Apple II computers with the graphics capabilities of Macintosh plus 40% greater screen resolution. The hardware gives the monitor a resolution of 640 dots by 768 lines, viewable in a moveable window of 640 dots by 384 lines. This resolution yields a picture 8 1/2 by 11 in. when dumped to a dot matrix printer. Software capabilities include rubberband line draw, pattern plot, shading, text insert, vector shape manipulation, and cursor control from the keyboard or Apple mouse. Plotting can also be accomplished by using a joystick or Koala pad.

748 GTD
Datamat Programming Systems, Inc., 81 Atlantic St., Stamford, Conn. 06901—Len Friedland, 203-967-4505 • Turnkey system consists of Olivetti M40 minicomputer, plotter, printer, 1mb RAM, two 1mb

floppies and software • Price: $10,000 for turnkey package; Updates: included with service/maintenance contract • Training: in-house or on-site (add $2,000).

GTD is an interactive minicomputer-based two-dimensional drafting system allowing menu, direct and digitizer input. Drawings are composed of primitives (points, lines, projection lines, circles, arcs, dimensions and text) and can be combined into groups. A group that is common to many prints can be stored on the disk as a symbol and recalled as desired. Drawings can be represented by different views (elevations), and each drawing can be composed of up to 30 layers (transparent overlays), any of which can be made visible or invisible.

749 HOK DESIGN
Hellmuth, Obata & Kassabaum, Inc., 100 North Broadway, St. Louis, Mo. 63102—Daniel C. Davis, 314-421-2000 • For use with any DEC-VAX computer using Tektronix display devices • Price: varies depending on application; Updates: included with service/maintenance contract • Training: seminar, in-house, on-site and manual.

HOK Design is both an ad hoc collection of specific design algorithms and an expert system for using the more sophisticated analysis capabilities of other HOK systems. Potential tasks include: circulation analysis, stadium seating layout, elevator analysis, solar calculations, energy modeling, natural lighting analysis, building and planning code checking, animated simulations and activity/time frequency diagrams. The expert system may be based on in-house capabilities or access to various on-line databases.

750 HOK DRAW
Hellmuth, Obata & Kassabaum, Inc., 100 North Broadway, St. Louis, Mo. 63102—Daniel C. Davis, 314-421-2000 • For use with any DEC-VAX computer using Tektronix display devices • Price: varies depending on application; Updates: included with service/maintenance contract • Training: seminar, in-house, on-site and manual.

HOK Draw is a computer-aided design and drafting system capable of producing a wide range of two- and three-dimensional drawings. Drawing types include plans, elevations, sections, perspectives,

parallel projections and axonometrics. The system uses a relational database management system and is supported on any DEC-VAX environment running VMS.

751 HOK IMAGE
Hellmuth, Obata & Kassabaum, Inc., 100 North Broadway, St. Louis, Mo. 63102—Daniel C. Davis, 314-421-2000 • For use with any DEC-VAX computer using Tektronix display devices • Price: varies depending on application; Updates: included with service/maintenance contract • Training: seminar, in-house, on-site and manual.

HOK Image is used to develop realistic images from models created using *HOK Draw*. The system will create shaded, color images on a color raster display. Output can be either 35mm slides or videotape.

752 HOK LAYOUT
Hellmuth, Obata & Kassabaum, Inc., 100 North Broadway, St. Louis, Mo. 63102—Daniel C. Davis, 314-421-2000 • For use with any DEC-VAX computer using Tektronix display devices • Price: varies depending on application; Updates: included with service/maintenance contract • Training: seminar, in-house, on-site and manual.

HOK Layout is used for both vertical (stacking) and horizontal (blocking) assignment. Assigns activities (spaces, workstations, etc.) to locations (buildings, floors, etc.) so that highly interrelated activities are placed in the same zone or adjacent zones and circulation from location to location is minimized. The *Layout* system evaluates and tracks alternate building geometries over time. The blocking process is interactive: the system evaluates solutions by indicating violations of size or relationship. The program is closely related to *HOK Space* (space and quantity needs over time), *HOK Draw* (interactive graphics), and *HOK Component* (standard component libraries).

753 HOK NEEDS
Hellmuth, Obata & Kassabaum, Inc., 100 North Broadway, St. Louis, Mo. 63102—Daniel C. Davis, 314-421-2000 • For use with any DEC-VAX computer using Tektronix display devices • Price: varies depending on application; Updates:

included with service/maintenance contract • Training: seminar, in-house, on-site and manual.

HOK Needs collects information regarding individual employee needs in terms of working styles, requirements and preferences, and communication requirements. The system maps needs, preferences and working styles ("soft" information) into "hard" requirements and recommendations for equipment and space. Later implementations may include actual workstation design capabilities such as square footage allocation, equipment selection, graphic display, and retrieval of HOK standards. Manufacturer-specific capabilities include component lists, specifications, purchase order information and graphic display.

754 HOK SPACE
Hellmuth, Obata & Kassabaum, Inc., 100 North Broadway, St. Louis, Mo. 63102—Daniel C. Davis, 314-421-2000 • For use with any DEC-VAX computer using Tektronix display devices • Price: varies depending on application; Updates: included with service/maintenance contract • Training: seminar, in-house, on-site and manual.

HOK Space defines the client's space needs and plans size and layout of building spaces. *HOK Space* is intended for gathering, storing and organizing quantitative and qualitative information (the architectural "program") about the needs of the occupants of buildings. *HOK Space* consists of an integrated set of procedures and computer programs that collect, update and report specific data. This information deals with the needs of operational groups which are (or will be) occupying a facility. The System is designed for three levels of detail: master program, base building program and interiors program.

755 HOK TRANSLATE
Hellmuth, Obata & Kassabaum, Inc., 100 North Broadway, St. Louis, Mo. 63102—Daniel C. Davis, 314-421-2000 • For use with any DEC-VAX computer using Tektronix display devices • Price: varies depending on application; Updates: included with service/maintenance contract • Training: seminar, in-house, on-site and manual.

HOK Translate converts *HOK Draw* information in and out of generic industry-standard formats. This data may then be read into other CADD systems. This system enables firm to share data with consultants and clients.

756 IC-1200
Integrated Computer Technologies, 1650 South Amphlett Blvd., Suite 224, San Mateo, Calif. 94402—Harman Cadis, 415-341-2946 • Turnkey package includes IBM PC-XT computer with 10mb hard disk, 8087 co-processor, graphics card, digitizing tablet with cursor, real-time clock, plotter, software installation, training and hotline • Price: $16,500; Updates: billable or free with service/maintenance contract • Training: in-house, on-site and manual, on-screen help-commands and hotline—free for one year.

IC-1200 is a two-dimensional computer-aided drafting system that operates on an enhanced version of *AUTOCAD* software. Among added capabilities are a 12-button cursor that works in combination with sub menus to generate over 100 command sequences (reducing keyboarding), symbols libraries driven by cards placed on the digitizer, and macro commands such as "elipse" or color, that permit multiple-commands execution with just one entry.

757 ICON SERIES 2000
Summagraphics Corporation, 777 State St. Extension, P. O. Box 781, Fairfield, Conn. 06430—Kathy Dunn, 203-384-1344 • Turnkey system consists of Data General Desktop Generation computer, 19-in. black-and-white graphic display; alpha/numeric display, fiberglass workstation and built-in 20-by-20-in. digitizing tablet; plotter and color display optional • Price: $50,000; Updates: included with service/maintenance contract • Training: seminars, in-house, on-site and manual.

ICON Series 2000 is a turnkey system/workstation that enables a user to create, preview, edit, store and recall a drawing, with text, on a graphic display. Drives many plotters for drawing output. Optional software modules are word processing, engineering/surveying, bill of materials, cost estimating/quantity take-off and a user's programmable module, which permits users to tailor the over-all system to their own needs.

758 IDP
Largo Soft International, 1 Hameasfim St. (Eliahu House), Tel-Aviv, Israel 64736—Telephone:03-256876, Telex 35301 LARGO IL. • For use with IBM PC, PC-XT and computers running MS-DOS or CP/M-86; requires 512k RAM, two 320k disk drives, graphics terminal, light pen and HP plotters • Price: $9,995; Updates: billable • Training: manual and computer-aided instruction.

IDP software performs two- and three-dimensional (wire-frame) preliminary design and drafting with instant recall/change, quantities take-offs, and zooming and plotting in any scale. Other features are isometric drafting of lines and overview of structure from frontal view.

759 IDRAW 3
Information Displays, Inc., 11222 LaCienega Blvd., Suite 660, Inglewood, Calif. 90304—Nancy E. Nicoll, 213-417-5386 • For use with Apollo DN 300, DN 320 or DN 550 computers with Summagraphics bit-pad and HP plotters • Price: $20,000; Updates: billable • Training: in-house and manual.

IDRAW 3 is a software-only or turnkey drafting system with more than 70 program functions available through simple menu selection. Expandable applications include mechanical and electrical engineering. Optional modules for the architectural package are a three-dimensional version ($10,000), materials-take-off ($6,000), scheduling ($6,000) and facilities management (no price information).

760 IGOS
MGS Inc., 2035 S. Arlington Heights Rd., Suites 114-115, Arlington Heights, Ill. 60005—John Scholten or Ed Hedlund, 312-437-2040 • Turnkey system includes DEC-PDP-11/73 with 50- or 200mb disk storage, two high-resolution screens and digitizer; drives any plotter • Price: from $45,000 for turnkey system with two screens and digitizer; Updates: available with maintenance contract • Training: in-house, on-site, manual and seminars.

IGOS is a self-contained two- and three-dimensional turnkey CADD workstation that can be interfaced with a mainframe or assembled into a multiple-user network. Primary applications are preliminary design, working drawings, space planning and facilities management.

Software features include bill of materials, take-offs and a fully relational database management system.

761 ILLUSTRATOR: ARCHITECTURAL RENDERING DESIGN SYSTEM
Auto-trol Technology, 12500 N. Washington St., P. O. Box 33815, Denver, Colo. 80233—Thomas C. Curry, 303-452-4919 • For use with Advanced Graphic Workstation-Apollo based; Supports HP, Calcomp or Versatec plotters, Seiko, TI and Tektronix hard copy • Price: $1,000; Updates; free • Training: seminar, in-house, on-site and manual.

Illustrator: Architectural Rendering Design System assists in the creation of presentation-quality renderings for client approval or for submittal to the appropriate commissions and agencies. The program includes a symbol library of over 70 basic figures, such as cars, trucks, people and vegetation, which can be inserted into existing plan, elevation, isometric or perspective drawings.

762 IMHOTEPH
Top-Ten Software, P. O. Box 6436, New York, N. Y. 10128—Lee Kennedy, RIBA, 212-188-6656 • For use with Apple II computers; requires Applesoft and 48k RAM • Price: $19.95—version 1; $99.95—version 2; add $2.50 for handling • Training: manual.

IMHOTEPH is intended for demonstrating the fundamentals of computer-aided design and drafting. Version 1 is menu driven and prompts the user after each action. Version 2 (available January 1985), also menu driven, is an advanced CAD trainer that includes drawing intelligence, recall of last points, figure library and modular rotatable text font.

763 INTERFACE DESIGNER 3-D SERIES
Interface Data Systems, 2990 E. LaJolla St., Anaheim, Calif. 92806—James B. Young, 714-630-8030 • For use with IBM PC, PC-XT or compatible microcomputers; uses Microsoft mouse, HP or Bausch & Lomb A-E-size plotters and Interface Micro 186 or Micro 286 monochrome or

color workstations; requires 256-1024k RAM • Price: from $1,295 depending on configuration; Updates: free first year; $500 per year thereafter • Training: seminar, manual.

Interface Designer 3-D Series is a modular, upgradable two- and three-dimensional design and drafting system capable of projecting or plotting plan or two- and three-dimensional perspective views simultaneously. Drafting module has auto-dimensioning, scale, pan, zoom and editing in two or three dimensions. Graphics generator module illustrates reaction of a structure to static or dynamic loads.

764 INTERGRAPH ARCHITECTURAL DESIGN AND DRAFTING SYSTEM
Intergraph Corporation, One Madison Industrial Park, Huntsville, Ala. 35807—Al Kemper, 205-772-2000 • Turnkey system consists of one computer workstation, hard printer, plotter and software. Systems are based on DEC-VAX and PDP-11 computers • Price: Basic systems start at $120,000; Updates: free with service/maintenance contract or billable • Training: in-house, on-site implementation plan, computer-aided instruction and manual.

Intergraph Architectural Design and Drafting System utilizes two software packages: *Interactive Graphics Design and Management System (IGDMS)* and *Data Management and Retrieval System (DMRS)*. IGDMS performs design and drafting functions. DMRS collects and manages all descriptive information associated with a design. Optional programs are listed separately.

765 INVENTORY
Decision Graphics Inc., 11 Main St., P. O. Box 306, Southborough, Maine 01772—John Nilsson, 617-481-4119 • For use with any VAX/VMS system; any terminal, any printer • Price: $5,000-$16,000; Updates: billable • Training: on-site, manual.

Inventory reads any *PEAC* (Decision Graphic's turnkey system—see 798 below) drawing and generates files containing all the elements in main and sub-drawings. Query function permits user to interactively search the inventory file and obtain reports on

quantities for any item or for all items in a drawing. Generates bill of materials reports from inventory files.

766 KEYSTONE CAD GRAPHICS

Keystone Project Management Systems, 235 S. Maitland Ave., Maitland, Fla. 32751—Stan Levine, 305-628-1932 • For use with CP/M, CP/M-86, MS-DOS and PC-DOS operating systems (includes computers from Texas Instruments, DEC, IBM and Wang); CP/M requires 53k RAM, 128k for all others; turnkey hardware package provides 46mb of disk storage; Software supports high-resolution CRT, digitizer or mouse and most plotters • Price: $4,500—$6,000 for software; Updates: billable • Training: seminar, in-house, on-site and computer-aided instruction.

Keystone CAD Graphics is a two-dimensional system for schematics. Performs design and planar drafting. Stores all entities as parametric data. Drawings may contain up to 128 layers. Displays grid points. Other features are snap mode, lettering in any size or orientation, symbols libaries, zoom and center. Software is part of a modular, stand-alone or multiple-user system with networking and database capability. Other interactive modules are project management and word processing (see 514 and 590 above).

767 KITCHEN DESIGNS BY COMPUTER

Graphic 100, P. O. Box 362, Nashua, N. H. 03061—Paul Paquin, 603-883-4990 • For use with Apple IIe with 128k RAM, two disk drives, monitor, Grappler Interface; Apple DMP printer or C. Itoh 8510 printer • Price: $1,995; Updates: billable • Training: seminar, in-house, on-site and manual.

Kitchen Designs by Computer will generate floor plans, elevations and perspectives for a kitchen from information supplied by a user. In its job-cost mode, the software will produce a quotation for 10 different kitchen styles from two lists of kitchen components.

768 MASTERCAD

InterCAD Corporation, 2525 Riva Rd., Annapolis, Md. 21401—Peter H. Donnelly, 301-224-2926 • Single workstation turnkey system is based on the Apollo DN 300; supports HP plotters • Price: $39,900 for single workstation; Updates: billable • Training: in-house, on-site, seminars and manual.

MASTERCAD turnkey system provides a set of application tools designed for facilities/space planners to: create office and plant layouts, input existing drawings, modify layouts, generate bills of material, and create symbols unique to a specific company's needs. *MASTERCAD* is available as a system based on the Apollo DOMAIN computer or as unbundled software for Apollo users.

769 MDX COMPUTER DRAFTING SYSTEM

PSI Systems Corporation, P. O. Box 21, Pittsburg, Kan. 66762—Phil Boatright, 316-231-5208 • Turnkey system includes MDX 150 desktop CPU with 10mb hard disk, a DWS 15 color workstation with 15-in. digitizer and HI or HP plotters for up to E-size drawings • Price: $35,000—$50,000 for turnkey system that includes hardware and software; Updates: $200 per year • Training: seminar, on-site and computer-aided instruction.

MDX Computer Drafting System is a stand-alone or networkable, two- and three-dimensional color drafting and design system featuring editing, layering, on-line help, full library of architectural symbols, user-created symbols, parts-list generator and bill of materials. Applications include site and facilities planning, mapping, hvac, electrical and piping.

770 MGI ARCHITECTURAL DRAFTER

Microcomputer Graphics, Inc., 13468 Washington Blvd., Marina Del Rey, Calif. 90292—Fred Roberts, 213-822-5258 • For use with IBM and other computers running MS-DOS; peripherals include Bausch & Lomb and HP plotters (A-E); Epson printers and Mitsubishi high-resolution monitors • Price: $5,995; Updates: free for first year, billable thereafter • Training: seminar, in-house, on-site, manual and computer-aided instruction.

MGI/Architectural Drafter generates two-dimensional working drawings on IBM PC and compatibles using keyboard alone for all functionals and operations. Auto construction lines provide a short cut in developing elevations. Standard features are user-

definable grids, database analysis for cost estimating and bill of materials and variable dimensioning. *Drawing Manager* program and symbols templates available.

771 MICAD

Micro-Installations, Inc., 260 Fifth Ave., New York, N. Y. 10001—Ira Hayes Fuchs, 212-889-6684 • Turnkey system comprises a 16-bit color graphics computer (uses 8086/8087 microprocessor), D-size plotter and digitizing tablet with 12-button cursor puck • Price: $15,000 for computer system; Updates: included with service contract • Training: System price includes 20-hours of on-site training; in-house training, manual and computer-aided instruction available as well.

MICAD is a two-dimensional design and drafting system running *AUTOCAD* software enhanced with *Graph-Facts. Graph-Facts* permits attributes to be assigned to any element in a drawing and enables users to perform material-cost take-offs, space-usage projections, hvac analyses and facilities management functions.

772 MICROCAD

Computer Aided Design of San Francisco, 764 Twenty-Fourth Ave., San Francisco, Calif. 94121—Shelli Johnson, 415-387-0263 • For use with IBM PC and most compatibles—2 disk drives preferred; requires 256k RAM, a digitizer (Bausch & Lomb DT-11 or Summagraphics MM1201) and plotter (Bausch & Lomb DMP or HP 7470/7475) • Price: $500-$650; Updates: cost of postage and mailer • Training: seminar, in-house, on-site and manual.

MICROCAD is an integrated two- and three-dimensional modeling and design system that permits the development and editing of plans, elevations, isometrics and perspectives. The program has an integral electronic spreadsheet or will accept input from Visicalc files and display data as high-resolution graphs. Also calculates center of gravity and moment of inertia.

773 MULTI-DRAW

Cymbol Cybernetics Corporation, 169 Colonnade Rd., Ottawa, Canada K2E 7J4—John Davies, Director of Marketing, 613-727-1880, Telex 053 3538 • Turnkey system includes Cymbol C-82 32-bit computer, 40mb hard disk, 19-in. monitor, 1mb floppy and furniture; system supports any brand-name plotter; Unbundled software can run on DEC-VAX 730 and up • Price: $20,000 for software; $39,000 for turnkey package; Updates: $400 per year includes hardware and software

maintenance, free updates and consultation • Training: on-site, manual or computer-aided instruction.

Multi-Draw is a two- and three-dimensional drawing package for preliminary, finished and working drawings. Complete take-off package and symbols library. Performs interior design, space planning and facilities management as well.

774 NOTATION

EMA Management Associates, Inc., 1145 Gaskins Rd., Richmond, Va. 23233—Terri Connell 804-740-8332 • For use with TRS Model 3/4, one disk drive and an 80- or 132-character printer with expanded letter capability • Price: $95; Updates: free • Training: manual.

Notation permits the preparation and re-use of descriptive notes and titles for drawings by sending special instructions to an expanded-letter dot matrix printer. Prints titles and the starting line for notes in large letters and automatically switches to normal letters for scale line and remaining notes. Notes can match computerized room finish and door schedules.

775 NPS

NPS Automation Services, Inc., 202 Johnson Rd., Morris Plains, N. J. 07950—Paul Zeman, 201-455-1311 • Software available unbundled, as part of turnkey system and through service bureau or timesharing; no hardware required for services or system rental; for system purchase, hardware and peripheral requirements depend on application and processing volume • Price: depends on configuration; Updates: free with service/maintenance contract • Training: seminar, in-house, on-site and computer-aided instruction.

NPS's multiple services include two- and three-dimensional design and drafting—site plans, perspectives, sections, details and floor plans with overlays. Related services are materials take-offs, estimating, space utilization and job-cost control.

776 PC CAD

Houseman & Associates, Box 474, Cypress, Texas 77429—Keith Houseman, 713-890-5160 • For use with IBM PC or PC-XT, digitizers, 36" x 48" plotters; requires 128k RAM • Price: $1,450; plotting option

available for $3,000; Updates: free • Training: seminar, in-house, manual or computer-aided instruction.

PC CAD is a design and drafting system that automates the design processs for contouring and earthwork and permits the development of fully annotated two-dimensional site plans with 16-digit accuracy.

777 PC-DRAW
Micrografx, Inc., 1701 N. Greenville, Suite 703, Richardson, Texas 75081—Linda Curtis 214-234-1769 • For use with IBM PC and compatibles with 128k RAM; requires graphics monitor, color/graphics adapter, graphics printer or plotter and two disk drives • Price: $395; Updates: billable • Training: manual and computer-aided instruction.

PC-DRAW is an interactive drawing system that enables users to create and save drawings. *PC-DRAW* supports any type or complexity of drawing through the use of free-hand drawing, symbols libraries and graphics functions including object scaling, rotation and placement. Supports IBM text and an alternate text (which supports multiple fonts). Multiple output formats are included. Also supports a light pen and HP plotters.

778 PLAN
Decision Graphics Inc., 11 Main St., P. O. Box 306, Southborough, Maine 01772—John Nilsson, 617-481-4119 • For use with any VAX/VMS system; Megatek workstation • Price: $5,000-$16,000; Updates: billable • Training: on-site, manual.

PLAN is a schematic planning package for building layout and equipment planning. Inputs are a problem description, such as a list of spaces with name, quantity and dimensions or areas, and relationship values between the adjacencies. Outputs are a bubble diagram, which can be modified and/or converted to a block plan and manipulated further. Envelope and cutout areas can be overlaid. Reports are available at any time for relationship violations.

779 PLAN: ARCHITECTURAL DRAFTING AND DOCUMENTATION SYSTEM
Auto-trol Technology, 12500 N. Washington St., P. O. Box 33815, Denver, Colo. 80233—Thomas C. Curry, 303-452-4919 • For use with Advanced Graphic Workstation-Apollo based; Supports HP, Calcomp or Versatec plotters, Seiko, TI and Tektronix hard copy • Price: $1,750; Updates; free • Training: seminar, in-house, on-site and manual.

Plan: Architectural Drafting and Documentation System is a drafting and documentation system for creating architectural floor plans. Included are column grids, electrical and plumbing symbology, stairs and vertical access and drawing annotation such as text, dimensions, and general notes. An extrude function creates three-dimensional wire frames from two-dimensional views.

780 PLOT 10 TEKNICAD
Tektronix, Inc., P. O. Box 1000, Wilsonville, Ore. 97070—Andrew Davis, 503-685-3785 • Software runs on Tektonix *Smart Workstations* or Tektronix display terminals with stand-alone graphics processor • Price: $1,600 for software; turnkey packages range from $18,000 to $35,000; Updates: free during first year; included with annual maintenance agreement thereafter • Training: seminars, in-house, on-site and manual.

PLOT 10 TEKNICAD is a menu-driven two-dimensional design and drafting system intended primarily for the creation of mechanical, electrical, facilities and structural drawings. Follows ANSI Y14 and ISO drafting standards. Other capabilities are zoom and pan, stock and user-generated symbols libraries and point, line and arc input modes.

781 PLOTS
Decision Graphics Inc., 11 Main St., P. O. Box 306, Southborough, Maine 01772—John Nilsson, 617-481-4119 • For use with any VAX/VMS system; peripherals: Calcomp pen and electrostatic plotters, Tektronix ink-jet color copiers and 4100 terminals • Price: $5,000-$16,000; Updates: billable • Training: on-site and manual.

PLOTS is a set of four programs that provide complete, sophisticated graphic output including overlays, pen controls, composite assembly and scaling. Graphic output can be directed to a screen for viewing or to a plotter for hard copy.

782 PRO DRAFT
Bausch & Lomb, P. O. Box 14547, Austin, Texas 78761—Jerry Norman, 512-837-8952 • Turnkey system consists of minicomputer control unit/Winchester disk drive, Raster display, detached keyboard, menu tablet and single-sheet plotter for up to D-size drawings; digitizers optional • Price: $29,900; Updates: included with maintenance agreement • Training: in-house, on-site and manual.

PRO DRAFT is a turnkey package for two-dimensional design and drafting that can be customized for any of five applications: residential, commercial, light commercial, renovation and hvac. The system features drafting libraries, layering and a one-touch command control for scaling, rotation, border, drawing-size and line weight. A bill-of-materials module is available for $2,000.

783 QXDRAW
American Small Business Computers, 118 S. Mill Rd., Pryor, Okla. 74361—Bob Webster, 918-825-4844 • For use with Epson QX-10 • Price $99.95; Updates: nominal charge • Training: manual.

QXDRAW permits Epson *QX-10* users to create virtually any kind of drawing on an empty screen. The software generates lines in any style or width, including function curves connecting two or more points. Text and geometric figures, including ovals, can be created on screen, retreived and placed in any position in any scale, any number of times. The program is provided with clear documentation and on-screen help.

784 RANDMICAS
The Rand Group, 17430 Campbell Rd., Suite 14, Dallas, Texas 75252—Ross Wheeler, 214-661-0124 • For use with IBM PC-XT, 43xx, 33xx; DEC-VAX; Sun Systems; Mascomp; Pixel; Wang 2200; requires 10mb hard disc minimum, graphic CRT and plotter • Price: $7,000 and up; Updates: free for first year; billable thereafter.

RANDMICAS is an interactive finite element analysis and design system built around a full-relational database. Included in the system are modules for steel design, concrete design, static analysis and dynamic analysis. The system also has full two- and three-dimensional graphics with a comprehensive analysis post processing system. *RANDMICAS* interfaces directly to other *CAD/D* systems.

785 RUCAPS
GMW Computers, Inc., North America, 1417 4th Ave., Seattle, Wash. 98101—Thomas G. Phillips,206-467-0660 • For use with any Prime 32-bit virtual memory computers or DEC-PDP-11 minicomputers (Europe only); Imlac, Tektronix, Sigma and VT100 displays; Calcomp 900, 1000, HP 7500, Benson-Varian or Versatec plotters • Price: Software is available separately or as part of a complete turnkey system. Prices start at $65,000 for software and $160,000 for turnkey system; Updates: two upgrade enhancements per year free • Training: seminars, in-house, on-site and manual.

RUCAPS is a three-dimensional building modeling system that produces schematics to working drawings from a single three-dimensional model. Changes made to the model updates all drawings. Optional *Imager* module performs simulations with full color, texture and shading. *RUCAPS* also performs engineering analyses, interference checking, quantities take-offs and cost-estimating.

786 SCULPTURED SURFACES
Intergraph Corporation, One Madison Industrial Park, Huntsville, Ala. 35807—Al Kemper,205-772-2000 • A basic turnkey system consists of one computer workstation, hard printer, plotter and software. Systems are based on DEC-VAX and PDP-11 computers • Price: Turnkey package with software starts at $120,000; Updates: free with service/maintenance contract • Training: in-house, on-site implementation plan, computer-aided instruction and manual.

Sculptured Surfaces supports the precise mathematical definition of complex surfaces. Structures such as spiral staircases or domed and vaulted ceilings can be defined with the precision necessary for engineering purposes.

787 SIGMA III
Sigma Design, Inc., 7306 S. Alton Way, Englewood, Colo. 80112—Vicki Morris-Hart, 303-773-0666 • Turnkey system consists of an M68000-based 16/32-bit microprocessor, 1mb processor memory (min.), 30mb mass disk storage (min.), monochrome or color monitor, choice of input devices,

cabinet, workstation furniture and software • Price: from $90,000; Updates: billable • Training: seminars and in-house.

SIGMA III is a two- and three-dimensional design and drafting system with software applications for programming through working drawings and space planning/facilities management. Upgradable memory permits large workstation networks.

788 SITE ENGINEERING

Computervision Corporation, 100 Crosby Dr., Bedford, Mass. 01730—Ben Smith, 617-275-1800 • Software is available only as part of a turnkey package which incorporates Computervision CDS 4000 • Updates: billable or included with maintenance contract • Training: in-house, manual and computer-aided instruction.

Site Engineering provides the capability to convert conventional survey input or a tracing of a predrawn plan into a digitally modeled representation of the site. Using digital terrain modeling techniques, profile, cross-section, and alignment drawings can be created. Also, earthwork calculations can be determined. Requires *General Mapping*.

789 SPACEPLAN/3000

Computervision Corporation, 100 Crosby Dr. Bedford, Mass. 01730—Ben Smith, 617-275-1800 • Software is available only as part of a turnkey package which incorporates Computervision CDS 4000 equipment • Updates: billable or included with maintenance contract • Training: in-house, manual and computer-aided instruction.

SPACEPLAN/3000 optimizes the use of space in a new, existing, or multistructure project. Spatial affinities, including weighted relationships, form the basis for the space definition, stacking and diagram phases and supporting reports. The same affinities are the criteria against which the resulting graphic block layout and alternatives are automatically evaluated and reported on.

790 STRATEGIC PLANNING

Intergraph Corporation, One Madison Industrial Park, Huntsville, Ala. 35807—Al Kemper,205-772-2000 • A basic turnkey system consists of one computer workstation, hard printer, plotter and software. Systems are based on DEC-VAX and PDP-11 computers • Price: Turnkey package with software starts at $120,000; Updates: free with service/maintenance contract • Training: in-house, on-site implementation plan, computer-aided instruction and manual.

Strategic Planning package offers information on corporate structure, projected growth rates, buildings, leasing arrangements, the various activities conducted by the organization, and adjacency data, which can be readily stored and manipulated. Output from this database—in the form of stacking diagrams, adjacency matrices, bubble diagrams and reports—provides management with the summary information required for intelligent planning.

791 SYNTHAVISION

Mathematical Applications Group Inc., 3 Westchester Plaza, Elmsford, N. Y. 10523—Rick Betts, 914-592-4646 • For use with IBM 4300 and 3000 series, DEC-VAX and Apollo; requires 1 mb RAM and 2 mb disk storage • Price: $30,000 to $125,000; Updates: available with maintenance contract • Training: in-house, on-site and computer-aided instruction.

Synthavision offers three-dimensional solids modeling to construct and analyze any object. Complete hidden line removal. Color-shaded pictures with or without shadows. Menu has 18 primitives. Software interfaces with CADAM package to generate engineering drawings from the solid-model database. IGES interface.

792 TECHNIQUE NO. 9 SERIES

Microlight-Technique Architectural Software, 4438 Valencia Ave., North Vancouver, British Columbia V7N 4B1—John W. Whalen, 604-980-5353 or 604-926-7808 • For use with all IBM, IBM-compatibles and Tandy 2000. Supports most input and output devices; E-size drawings via Calcomp 965 plotter; other plotters: HP, Bausch & Lomb • Price: from $3,500 CDN; Updates: free during first year; billable thereafter •

Training: seminar, in-house, on-site, manual and computer-aided instruction.

Technique No. 9 Series generates two- or three-dimensional sketches, schematics and working drawings. Among features are full primitives generation, element or block erasure, data manipulation mode, color layer separation and details libraries. Data from the graphics package can be used for take-offs, inventories, scheduling or other user-defined options.

793 3-D MODELING

Intergraph Corporation, One Madison Industrial Park, Huntsville, Ala. 35807—Al Kemper, 205-772-2000 • A basic turnkey system consists of one computer workstation, hard printer, plotter and software. Systems are based on DEC-VAX and PDP-11 computers • Price: Turnkey package with software starts at $120,000; Updates: free with service/maintenance contract • Training: in-house, on-site implementation plan, computer-aided instruction and manual.

3-D Modeling package allows the architect to quickly produce and test several alternative design solutions visually, replacing the task drawing renderings by hand. Designs can be viewed in perspective from any angle, and presented to a client as fully shaded, color-filled models. Colors and shadows can be readily changed, and a structure presented as it would appear under different lighting conditions or with different finishes.

794 3D/CAD

Archon Software, 218 West Main St., Charlottesville, Va. 22901—Stuart G. Burgh, 804-295-2600 • For use with: IBM PC, NEC or Gigatek monitor, Mouse Systems mouse; supports Houston Instruments digitizers and plotters; requires 256k RAM • Price: $950; Updates: free • Training: seminar, manual.

3D/CAD creates three-dimensional models interactively using a mouse, digitizer or keyboard input. Rotates objects in three-dimensional perspective. Employs macro-object definition to create libraries of three-dimensional shapes. Hidden

line removal and plane clipping soon available. Interfaces with *CAD/2D* to extrude any two-dimensional drawing into a three-dimensional form.

795 3DESIGN/3

Tritek Vision Systems, 4710 University Way N. E., Suite 1512, P. O. Box C56789, Seattle, Wash. 98105—Kris Nelson, 206-632-2125 • For use with IBM PC and compatibles; requires IBM or Halo-supported color graphics board, 196k RAM, two 320kb disk drives; peripherals include digitizer, mouse, dot matrix printers and plotter • Price: $1,200; Updates: free for first six months, nominal fee thereafter • Training: manual and tutorials.

3DESIGN/3 features advanced editing that allows users to create complex objects and then rotate, scale and move them and remove their hidden lines. *3DESIGN/3*'s two-dimensional drafting package includes auto-dimensioning, window and overlay commands, text and crosshatching. Optional conversion program permits interface to *AUTOCAD*. A *Solidshade* option color-fills and shades with a variable light source.

796 TOUCH-'N DRAW

Arrigoni Technology Inc., 14127 Capri Dr., Los Gatos, Calif. 95030—David Arrigoni, 408-370-1400 • Turnkey system consists of MC68000 CPU, 1.5mb RAM, 33mb disk storage, 8 RS-232 ports, "Touch Control Station" and display module with 1280 x 1024 8-color 19-in. monitor • Price: $77,000 with D-size plotter: Updates: cost varies depending on complexity of update • Training: seminar, in-house, on-site, manual and computer-aided instruction.

TOUCH-'N DRAW is a turnkey architectural design and production drawing system for small-to-medium-size firms that includes grids, symbols libraries, layering, dimensioning and take-offs as part of the base package. Optional programs are interior design, facilities management and plumbing.

797 2D/CAD

Archon Software, 218 Main St., Charlottesville, Va. 22901—Stuart G. Burgh, 804-925-2600 • For use with: IBM PC, NEC or Gigatek monitor, Mouse Systems mouse; supports Houston Instruments digitizers and plotters; requires 256k RAM • Price: $1,950; Updates: free • Training: seminar, manual.

2D/CAD is a two-dimensional design and drafting system that creates drawings using a mouse, digitizer pad, or the keyboard. User-defined template libraries may be quickly created, filed and recalled to the screen for use. Selectable grids, multiple drawing levels and bi-directional zoom are standard features. Drawings are easily plotted at any time.

798 TWODEE

Decision Graphics Inc., 11 Main St., P. O. Box 306, Southborough, Maine 01772—John Nilsson, 617-481-4119 • For use with any VAX/VMS system; peripherals: W4109 or W4115 graphic workstation • Price: $5,000-$16,000; Updates: billable • Training: on-site, manual.

TWODEE is a general prupose design and drafting program aimed primarily at facilities planning but used also for architectural design/drafting and electrical and hvac drafting. *TWODEE* can fetch, store, zoom, pan, draw, add symbols, calculate, move, rotate, mirror, dimension, etc. High precision database allows work at any scale and automatic metric conversion.

799 VISUALIZATION PACKAGE

Computervision Corporation, 100 Crosby Dr., Bedford, Mass. 01730—Ben Smith, 617-275-1800 • Software is available only as part of a turnkey package which incorporates Computervision CDS 4000 equipment • Updates: billable or included with maintenance contract • Training: in-house, manual and computer-aided instruction.

Visualization Package provides the capability for generating one-, two-, or three-point perspective drawings with automatic hidden line removal on perspectives. Requires *General Building Design, General Mapping,* or *Piping Design.*

806 ACDS 7000

ACDS Graphic Systems Inc., 100 Rue Edmonton St., Suite 232, Hull, Quebec J8Y 6N2—Dave Strutt, 819-770-9631 • Turnkey system consists of 32-bit super micro, 1.5mb RAM, 35mb disk storage (expandable) dual-screen workstation, Bit Pad digitizer, keyboard and word processing software; plotter not included • Price: $25,000 to $50,000; optional software modules: *HUB*—$16,000, *Lattice*—$8,000, *DBMS*—$8,000, *User Extensibility Environment*—$16,000; Updates: included with service and maintenance contract or billable • Training: seminars, on-site, in-house and manual.

ACDS 7000 is an interactive turnkey drafting and design system assembled around a 32-bit super-microcomputer that can support up to six workstations. Four modules available for the system provide varying capabilities: Features of *HUB*, the two-dimensional design and drafting module, are area calculations, floor-plan generation, symbols library, bill of materials and scheduler, site plans, urban planning and road layout. The *Lattice* module is a three-dimensional surface modeling package with walk-thrus and hidden-line and surface removal. *DBMS* module is a network database management system with a query language for specs, take-offs, schedules, reports and structural analysis. *User Extensibility Environment* is a run-time macro generator for creating personalized applications.

807 A/E CADD 200

ECOM, 8634 West Brown Deer Rd., Milwaukee, Wisc. 53224—Ellen Henson, 414-354-0243 • For use with HP series 200 computers and peripherals • Price: from $32,300 for turnkey system, ECOM software modules $1,000; Updates: billable • Training: 8 hours of on-site training free, billable thereafter—manual and in-house training also available.

A/E CADD 200 is a two-dimensional drafting package built around the HP EGS-200 Graphics Editor enhanced with any combination of three customized modules: structural with standard details, architectural with standard details and office planning and layout.

808 ARVAC

SKOK Systems Inc., 222 Third St., Cambridge, Mass. 02142—Steve O'Neill, 617-868-6003 • For use with *Artech Designstation* (see 695 and 699 in Section 5). Price: $7,500; discounts available for multiple purchases; Updates: included with service/maintenance contract • Training: seminar, in-house, on-site and manual.

ARVAC is a drafting and analysis product for heating, ventilation and air-conditioning design (hvac). Standard duct and pipe sections are stored in a library, and each section-junction is automatically selected and drawn as a layout proceeds. Flow and performance analysis are possible in concert with the *ARBASE* relational database product.

809 AYCAD

Aydin Controls, 414 Commerce Dr., Ft. Washington, Pa. 19034—Ron Schlie, 215-542-7800 • Turnkey system consists of Aydin Controls multiple microprocessor CPU, 21mb Winchester disk drive, 1.2mb floppy disk drive, 1mb main memory, 13-in. (monochrome) and 19-in (color) monitors, 12-by 12-in. digitizing tablet, ASCII keyboard and software • Price: $47,500; Updates: included as part of license fee • Training: in-house, on-site.

The *AYCAD* turnkey system is a two- and three-dimensional (wire-frame) design and drafting system for schematics, other preliminary design documents and working drawings. Also performs word processing and structural analysis.

810 BEAMJOIS

J. J. Jordan, Architect-Engineer, 5236 Overbrook Way, Sacramento, Calif. 95841—Jim Jordan, 916-332-6610 • For use with IBM PC, PC-XT or compatibles, one disk drive and printer or TRS-80 1, 3 or 4, one disk drive and a printer; requires 48k RAM • Price: $83.32 for TRS-80; $98.32 for IBM PC (one-time license fee); Updates: $8 plus materials and handling • Training: manual and computer-aided instruction.

Beamjois selects size and grade of Douglas Fir lumber or pre-manufactured joist for any simple or cantilevered span with distributed, partial-distributed and up to three concentrated loads.

811 CADKEY

Micro Control Systems, Inc., 27 Hartford Turnpike, Vernon, Conn. 06066—Helen Charov, 203-647-0220 • For use with IBM PC or compatible microcomputers; requires 384k RAM,

one 320k floppy disk drive, color graphics adaptor card, graphics monitor, 2-D/3-D digitizer or mouse and a pen plotter or dot matrix printer • Price: $1,495; Updates: billable • Training: seminar, in-house, on-site, manual and computer-aided instruction.

Cadkey is an interactive two- and three-dimensional design and drafting system with primary applications that include mechanical design, detailed drafting, architectural engineering and schematics. Functions include automatic dimensioning, hidden-line removal, three-dimensional transforms, fillets and chamfers. Command structure can be modified to resemble many larger CAD/CAM system command formats.

812 CEADS-CIVIL/MAPPING
Holguin, 5822 Cromo Dr., El Paso, Texas 79912—Bob Whitus, 915-581-1171 • Turnkey packages are assembled from the following hardware: HP 9000, Series 200, Wang 2200 VP/LVP/MVP and HP 86 and 87;. supports HP 7580 or 7580A plotters and a variety of digitizers and printers • Price: $2,500 to $100,000 (software only to full bundled turnkey system); Updates: included with service/maintenance contract or billable • Training: seminar, on-site and manual.

CEADS—Civil/Mapping systems consist of fully integrated modules, such as disk management, field control, coordinate geometry, master design, automated drafting, earthwork and others. The package includes basic drafting, COGO, profile sheets, hydraulic/hydrologic and structural. All systems share a common database.

813 CLM COGO
CLM/Systems, Inc., 3654 Gandy Blvd., Tampa, Fla. 33611—C. L. Miller, 813-831-7090 • For use with IBM PC-XT, Sage IV, TI Professional, Wang PC; Supports HP, HI, Calcomp and Numonics plotters; compatible digitizers are HI, Calcomp and Numonics; requires 512k RAM • Price: $4,950; turnkey package also available for $25,000—includes 4 graphics terminals, D-size plotter, 20-by 20-in. digitizer and multi-mode printer; Updates: free • Training: seminar, in-house, on-site, manual and computer-aided instruction.

CLM COGO produces preliminary and final drawings for site planning, topography, grading, drainage, roads and utilities. Produces preliminary and final cost

estimates from a variety of schedules. Program options include a relational database, word processor and spreadsheet.

814 COMPUTERVISION HVAC PACKAGE
Computervision Corporation, 100 Crosby Dr., Bedford, Mass. 01730—Ben Smith, 617-275-1800 • Software is available only as part of a turnkey package, which incorporates Computervision CDS 4000 equipment • Price: N/A; Updates: billable or included with maintenance contract • Training: in-house, manual and computer-aided instruction.

Computervision hvac provides programs for heating, ventilating, and air conditioning load computation (ASHRAE 1981), duct calculations and round-to-rectangular duct equivalency conversion. Includes intelligent duct system schematics that can be automatically covered to double-line detail drawings.

815 CPS-1 (CONTOUR PLOTTING SYSTEM)
Radian Corporation, 8501 Mo-Pac Blvd., Austin, Texas 78766—Carl Kurz, 713-686-8481 • For use with IBM PC-XT or any mainframe computer handling a 32-bit sized word or larger • Price: $18,000 for base system; options are additional; Updates: free with service/maintenance contract • Training: seminars, in-house, manual, on-site and computer-aided instruction.

CPS-1 is a computerized mapping system designed for use in the energy, engineering and cartographic industries for gridding, profiling, volumetrics, three-dimensional displays, multiple surface and fault handling and three-dimensional seismic migration in a batch environment.

816 CPS-1/G
Radian Corporation, 8501 Mo-Pac Blvd., Austin, Texas 78766—Carl Kurz, 713-686-8481 • For use with most mainframe computers • Price: $35,000; Updates: included with service/maintenance contract • Training: seminars, on-site, in-house, manual and computer-aided instruction.

CPS-1/G is an interactive mapping system used either as a stand-alone software system or as an interface to the batch program *CPS-1* (see 815 above). The program provides interactive gridding, contouring, contour editing and control point editing.

817 CUSTOMER DIRECT SERVICE NETWORK SOFTWARE
The Trane Company, 3600 Pammel Creek Rd., LaCrosse, Wisc. 54601—Eugene L. Smithart, 608-787-3747 • For use with IBM PC-XT, DEC Rainbow 100/100+, Radio Shack 2, 4, 12, 16 and Apple II/IIe • Price: $995; Updates: billable • Training: seminar, in-house, on-site, manual and computer-aided instruction.

Customer Direct Service Network Software comprises 14 micro-based and mainframe programs for hvac system design including *TRACE* load-design, equal-friction duct design, coil, fan and air-handling selection programs, *VARITRANE* duct design and the *TRACE* and *TRACE II* economics programs.

818 DAYLITE
Solarsoft, Inc., 1406 Burlingame Ave., Suite 3l, Burlingame, Calif. 94010—Christine Ashton, 415-342-3338 • For use with Apple 3, Lisa and IBM PC • Price: $750; Updates: free for first six months, billable thereafter • Training: manual and help screens.

Daylite analyzes a variety of roof and wall aperture types and tilted glazing. Calculates hourly absolute illuminance, resultant hourly solar heat gains, glare, contrast and yearly lighting power budgets for any of five electric light strategies.

819 DIAFRAMS
J. J. Jordan, Architect-Engineer, 5236 Overbrook Way, Sacramento, Calif. 95841—Jim Jordan, 916-332-6610 • For use with IBM PC, PC-XT or compatible, one disk drive and a printer or TRS-80 1, 3 or 4, one disk drive and a printer; requires 48k RAM • Price: $49.61 for TRS-80; $74.61 for IBM PC (one-time license fee); Updates: $8 plus materials and handling • Training: manual and computer-aided instruction.

Diaframs determines wind shear on walls and diaphragms, class, thickness, nail schedule and grade for plywood roof and floor diaphragms. Shear and direct loads analyzed.

820 DIGITRAK
Chempro Data Sciences Corp., 507 Southampton Rd., Westfield, Mass. 01085—Norman St. Martin 413-562-2353 • For use with: IBM PC-XT, color or monochrome monitors, Digitrak sonic digitizer; supports most plotters; requires 192k RAM and 320k disk storage • Price: $5,470; Updates: free for first year, billable thereafter • Training: seminars, in-house, on-site, computer-aided instruction, manual, and telephone support.

Digitrak is a design and drafting system with applications including mechanical, lighting, hvac and energy/solar. Among capabilities are axis, grid, snap with rubber band, layering, line, circle, arc, fillet, change, copy, move, text erase and plot.

821 DIMENSION III
Calma Company, 2901 Tasman Drive, Santa Clara, Calif. 95050—T. Sherman, 408-748-9600 • Turnkey system based on the Data General 16-bit Eclipse, DEC 32-bit VAX, or 32-bit Apollo computers • Price: costs vary depending on hardware and software configuration; Updates: billable • Training: seminar, in-house, on-site, manual and computer-aided instruction.

Dimension III is a core software system for design and drafting in architecture, engineering and construction that supports any of nearly a dozen specific application packages. These include civil-site preparation, steel layout and design, two-dimensional architectural drafting and facilities layout.

822 EARTHWORK
F. J. Rospond Associates, 395 Franklin St., Bloomfield, N. J. 07003—Anthony Mascia, 201-429-9888 • For use with HP Series 80 computers and printers; requires 16k RAM • Price: $500; Updates: free • Training: manual.

Earthwork computes earthwork quantities by average-end-area method. Computes the change in volume of an area based on given parameters. Any number of cross sections can be input for both cut and fill. Takes building slab and pavement thickness into account.

823 ELECTRICAL: ELECTRICAL DRAFTING AND DOCUMENTATION SYSTEM
Auto-trol Technology, 12500 N. Washington St., P. O. Box 33815, Denver, Colo. 80233—Thomas C. Curry, 303-452-4919 • Turnkey system utilizes Auto-trol Advanced Graphic Workstation-Apollo based; supports HP, Calcomp or Versatec plotters and Seiko, TI and Tektronix hard-copy printers • Price: $3,500; Updates: free • Training: seminar, in-house, on-site and manual.

Electrical Drafting and Documentation System incorporates industry-standard symbology and techniques to produce panel, lighting and electrical equipment layouts in the building-plan view. Also produces riser diagrams for power and communications distribution. Includes standard schedule formats. Program can be integrated with other Auto-trol applications.

824 EUCLID/BUILDING DESIGN
Matra Datavision, 99 South Bedford St., Burlington, Mass. 01803—Miguel Suarez, 617-229-2630 • For use with VAX running VMS or IBM running VM/CMS • Price: $75,000 for base package, $7,500 for one access to a workstation, $5,000 for Building Design module, Updates: included with maintenance agreement • Training: in-house, on-site, manual and computer-aided instruction.

Euclid/Building Design computer software system performs solids modeling, design, drafting, analysis, numerical control output, database management and flexible visualization. The system is optimized for architecture with a "Building Design" module which enables users to create various types of models and then extract formwork drawings, data for structures computations and quantities of parts or materials.

825 F-CHART
Solarsoft, Inc., 1406 Burlingame Ave., Suite 3l, Burlingame, Calif. 94010—Christine Ashton, 415-342-3338 • For use with Apple 2, 3 and IBM PC • Price: $400; Updates: free for first six months, billable thereafter • Training: manual and help screens.

F-Chart aids in the design of active collector systems for space heating, domestic hot water, swimming pool heating and process heating needs. Handles both liquid and air-based systems. Includes an economic analysis section.

826 FINITE ELEMENT MODELING SYSTEM
Intergraph Corporation, One Madison Industrial Park, Huntsville, Ala. 35807—Al Kemper, 205-772-2000 • A basic turnkey system consists of one computer workstation, hard printer, plotter and software. Systems are based on DEC-VAX and PDP-11 computers • Price: Turnkey package with software starts at $120,000; Updates: free with service/maintenance contract or billable • Training: in-house, on-site implementation plan; computer-aided instruction and manual.

Finite Element Modeling provides the capability to generate two- and three-dimensional finite element models for framed, surface and solid structures. This software automatically generates loading conditions and model and rational constraints. Interfaces readily with third-party analysis programs, such as *GTSTRUDL*. Analysis results may be displayed to show displaced nodes and deformed elements superimposed on the original model.

827 GEOCONTOUR
Geocomp Corp., 342 Sudbury Rd., Concord, Mass. 01742—W. Allen Marr, 617-369-8304 • For use with IBM PC; requires graphics card, screen, pen plotter and 256k RAM • Price: $500; Updates: billable • Training: manual.

Geocontour permits user to establish contours of equal values between data points.

828 HEATCOOL
J. J. Jordan, Architect-Engineer, 5236 Overbrook Way, Sacramento, Calif. 95841—Jim Jordan, 916-332-6610 • For use with IBM PC, PC-XT or compatibles, one disk drive and a printer or TRS-80 1, 3 or 4, one disk drive and a printer; requires 48k RAM • Price: $84.76 for TRS-80; $99.76 for IBM PC (one-time license fee); Updates: $8 plus materials and handling • Training: manual and computer-aided instruction.

Heatcool determines heat loss and gain for selecting *hvac*, BTUH and CFM sizes for a building, room by room. Fast results when trying different factors and configurations.

829 HELIOS
Leonard A. Rydell, P. E., P. L.S., 601 Pinehurst Dr., Newberg, Ore. 97132—Leonard A. Rydell, 503-538-5700 • For use with any 48k computer with dual disk drives; written in North Star Basic; printer optional • Price: $295; Updates: free • Training: manual and computer-aided instruction.

Helios calculates heat gain and heat loss for skin-dominated structures. Allows user to change any of 25 building-configuration parameters, including size, shading and window orientation, to calculate the monthly and annual differences in total heating cost.

830 HOK DESIGN
Hellmuth, Obata & Kassabaum, Inc., 100 North Broadway, St. Louis, Mo. 63102—Daniel C. Davis, 314-421-2000 • For use with any DEC-VAX computer using Tektronix display devices • Price: varies depending on application; Updates: included with service/maintenance contract • Training: seminar, in-house, on-site and manual.

HOK Design is both an ad hoc collection of specific design algorithms and an expert system for using the more sophisticated analysis capabilities of other HOK systems. Potential tasks include circulation analysis, stadium seating layout, elevator analysis, solar calculations, energy modeling, natural lighting analysis, building and planning code checking, animated simulations and activity/time frequency diagrams. The expert system may be based on in-house capabilities or access to various on-line databases.

831 HVAC
Cymbol Cybernetics Corporation, 169 Colonnade Rd., Ottawa, Canada K2E 7J4—Solly Patrontasch, 613-727-1880, Telex 053 3538 • Turnkey system includes Cymbol C-82 32-bit computer, 40mb hard disk, 19-in. monitor, 1mb floppy and furniture; supports any brand plotter; unbundled software runs on DEC-VAX 730 and up • Price: $20,000 for software; $39,000 for turnkey package; Updates: $400 per year includes hardware and software maintenance, free updates and consultation • Training: on-site, manual and computer-aided instruction.

HVAC handles complete duct design, architectural layout, shop drawings, and patterns for all fittings, square or round.

832 HVAC: HVAC DRAFTING AND DOCUMENTATION SYSTEM
Auto-trol Technology, 12500 N. Washington St., P. O. Box 33815, Denver, Colo. 80233—Thomas C. Curry, 303-452-4919 • Turnkey system utilizes Auto-trol Advanced Graphic Workstation-Apollo based; Supports HP, Calcomp or Versatec plotters and Seiko, TI and Tektronix hard copy printers • Price: $3,500; Updates: free • Training: seminar, in-house, on-site and manual.

Hvac Drafting and Documentation System incorporates functions for producing rectangular, round and flexible ductwork layouts consistent with SMACNA standards. Also drafts hvac piping systems, places major equipment and annotates drawing elements.

833 IMAGES-2D
Celestial Software Inc., 125 University Ave., Berkeley, Calif. 94710—Nancy Halladay, 415-841-7175 • For use with IBM PC, PC-XT and compatibles; requires color graphics adaptor board, color monitor, printer and 192k RAM • Price: $1,300 ($500 for static-analysis only); Updates: free for first 6 months, billable thereafter • Training: manual.

Images-2D performs two-dimensional static and dynamic analysis and seismic analysis of engineering structures and systems. Handles 100 nodes with 300 degrees of freedom. Results are obtained for static loading, natural frequencies and mode shapes and dynamic response to input response spectra. Menu-driven or batch-mode execution.

834 IMAGES-3D
Celestial Software Inc., 125 University Ave., Berkeley, Calif. 94710—Nancy Halladay, 415-841-7175 • For use with IBM PC, PC-XT and compatibles; requires 512k RAM, color graphics adaptor board, color monitor and printer • Price: $3,900 ($1,500 for statics-only version); Updates: free for first 6 months, billable thereafter • Training: manual.

Images-3D performs three-dimensional static and dynamic analysis, stress analysis, code evaluation and seismic analysis of engineering structures and systems. Permits the generation and display of multi-colored models

from any perspective at any window. The program is menu-driven, interactive and includes "Help" commands and error trapping and error messages.

835 INTERFACE DESIGNER 3-D SERIES
Interface Data Systems, 2990 E. LaJolla St., Anaheim, Calif. 92806—James B. Young, 714-630-8030 • For use with IBM PC, PC-XT and compatible microcomputers; uses Microsoft mouse, Hewlett-Packard or Bausch & Lomb A-E-size plotters and Interface Micro-186 or Micro-286 monochrome or color workstations; requires 256-1024k RAM • Price: from $1,295 depending on configuration; Updates: free during first year, $500 per year thereafter • Training: seminar and manual.

Interface Designer 3-D Series is a modular, upgradable two- and three-dimensional design and drafting system capable of projecting or plotting plan or two- and three-dimensional perspective views simultaneously. Drafting module has auto-dimensioning, scale, pan, zoom and editing in two or three dimensions. Graphics generator module illustrates reaction of a structure to static or dynamic loads.

836 JOIST/ANSI
Newhof and Winer, Inc., 3975 Cascade Rd., S. E., Grand Rapids, Mich. 49506—Joe Kessenich, 616-949-5831 • For use with HP 86/87/9816/9836 and IBM PC; requires 64k RAM and 256k disk storage • Price: $425; Updates: free • Training: manual.

JOIST/ANSI performs an analysis of existing open-web steel joists. Self-generating geometry, snow loads generated based on ANSI A58.1-1982. Output includes all member axial loads, stresses and required reinforcement area.

837 MAX-PC MAPPING SOFTWARE
National Planning Data Corporation, 227 Fort Pitt Blvd., Pittsburgh, Pa. 15222-1570—Mary Davis, 412-471-6732 • For use with IBM PC-XT; requires 128k RAM • Price:

$1,500 not including cartographic boundary data; Updates: not applicable • Training: manual and on-line help messages.

MAX-PC Mapping Software produces thematic maps as an aid to analyzing and presenting spatially distributed information (demographic characteristics, housing values, historic buildings, commercial establishments or survey data from primary research). Applications encompass a wide range of urban planning and design applications, including site development studies, community needs assessments, real estate marketing and program planning and monitoring. Cartographic base files are available.

838 MICAD
Micro-Installations, Inc., 260 Fifth Ave., New York, N. Y. 10001—Ira Hayes Fuchs, 212-889-6684 • Turnkey system comprises a 16-bit color graphics computer (uses 8086/8087 microprocessor), D-size plotter and digitizing tablet with 12-button cursor puck • Price: $15,000 for computer system; Updates: included with service contract • Training: System price includes 20 hours of on-site training—in-house training, manual, and computer-aided instruction available as well.

MICAD is a two-dimensional design and drafting system running AutoCAD software enhanced with Graph-Facts. Graph-Facts permits attributes to be assigned to any element in a drawing and enables users to perform hvac analyses, material-cost take-offs, space-usage projections, and facilities management functions.

839 NETWORK ANALYZER FOR PIPING SYSTEMS
J. P. Axe, I. D., 1429 Crownhill Dr., Arlington, Texas 76012—John R. Axe, 817-277-2055 • For use with IBM PC, PC-XT, Compaq, Eagle and other IBM compatibles; also TRS-2000 and TRS-80 3/4 • Price: from $394.95; Updates: free or billable depending upon complexity of update • Training: manual and sample problems.

Network Analyzer for Systems is used for design of piping systems handling liquids, e.g., chilled water systems, fire sprinkler systems and hot and cold water service systems. The program is interactive and permits inputs to be saved, recalled and edited. Calculates pressure and flow in single and multiple branch piping systems.

840 NRG-2/COMMERCIAL ENERGY ANALYSIS
Disco-Tech/Morton Technologies, 600 B St., P. O. Box 1659, Santa Rosa, Calif. 95402—Ralph R. Russe, P. E., 707-523-1600 • For use with all microcomputers running CP/M-80, CP/M-86, MS-DOS or TRS-DOS • Price: $450; Updates: billable • Training: manual.

NRG-2/Commercial Energy Analysis permits users to fine-tune non-residential buildings for Title 24 compliance and energy efficiency. Calculates U-factor and OTTV values for each component type and entire building. Changes, adds, deletes values for any component (U-factor, area, shading-coefficient, etc.). Solves for maximum allowable U-factor for any component. Stores data for later use, displays and prints results.

841 PASS-ONE
Energy Management Consultants, Inc., 672 S. Lafayette Park Place, Suite 38, Los Angeles, Calif. 90057—Douglas S. Stenhouse, AIA, 213-383-3195 • For use with most microcomputers running CP/M; requires 60k RAM • Price: $1,000; Updates: billable • Training: seminars, in-house, on-site, manual and computer-aided instruction.

Pass-One performs passive annual solar heating analysis. Combines elements of the Princeton Energy Group's program (*PEG*) and *TEANET*. Capabilities include solar gain on windows for more than one orientation, shading devices, moveable insulation, thermostat set-back, ventilation and internal heat generation. Also calculates annual load for conventional buildings.

842 PLUMBING: PLUMBING DRAFTING AND DOCUMENTATION SYSTEM
Auto-trol Technology, 12500 N. Washington St., P. O. Box 33815, Denver, Colo. 80233—Thomas C. Curry, 303-452-4919 • Turnkey system utilizes Auto-trol Advanced Graphic Workstation-Apollo based; supports HP, Calcomp or Versatec plotters and Seiko, TI and Tektronix hard copy printers • Price: $3500; Updates: free • Training: seminar, in-house, on-site and manual.

Plumbing: Drafting and Documentation System drafts and sizes building plumbing systems for supply, waste, vent, and medical

gas piping. Fixture placement in plan and riser diagrams can also be created along with sizing calculations for hot water tanks and supply meters. All techniques and symbology follow the National Plumbing Code standards.

843 PRO DRAFT
Bausch & Lomb, P. O. Box 14547, Austin, Texas 78761—Jerry Norman, 512-837-8952 • Turnkey system consists of minicomputer control unit/Winchester disk drive, Raster display, detached keyboard, menu tablet and single-sheet plotter for up to D-size drawings; digitizers optional • Price: $29,900; Updates: included with maintenance agreement • Training: in-house, on-site and manual.

Pro Draft is a turnkey package for two-dimensional design and drafting that can be customized for any of five applications: residential, commercial, light commercial, renovation and hvac. The system features drafting libraries, layering and a one-touch command control for scaling, rotation, border, drawing-size and line weight. A bill-of-materials module is available for $2,000.

844 RANDMICAS
The Rand Group, 17430 Campbell Rd., Suite 14, Dallas, Texas 75252—Ross Wheeler, 214-661-0124 • For use with IBM PC-XT, 43XX, 33XX, DEC-VAX, Sun Systems, Mascomp, Pixeland and Wang 2200; requires 10mb hard disk minimum, graphic CRT and plotter • Price: $7,000 and up; Updates: free for first year, billable thereafter.

Randmicas is an interactive finite element analysis and design system built around a full-relational database. Included in the system are modules for steel design, concrete design, static and dynamic analysis. The system also has full two- and three-dimensional graphics with a comprehensive analysis post-processing system. The system interfaces directly to other CAD/D systems.

845 REENERGY
Raymond D. Reed, AIA, Reed Associates, P. O. Box 9863, College Station, Texas 77840—Raymond D. Reed, 409-693-8793 • For use with any IBM or compatible computer with 64k RAM and up; compatible printer desirable • Price: $100—includes instructions and data sheets; Updates: cost of disk plus mailing • Training: computer-aided instruction; reference books, help-line.

Reenergy is a menu-driven design tool. It determines energy efficient design strategies. Exactly parallels

the analysis techniques taught in AIA seminars. Permits the average architectural student or practitioner to make initial energy efficient design decisions within 20 minutes.

846 RETWALLS
J. J. Jordan, Architect-Engineer, 5236 Overbrook Way, Sacramento, Calif. 95841—Jim Jordan, 916-332-6610 • For use with IBM PC, PC-XT or compatibles, one disk drive and a printer or TRS-80 1, 3 or 4, one disk drive and a printer; requires 48k RAM • Price: $63.44 for TRS-80; $78.44 for IBM PC (one-time license fee); Updates: $8 plus materials and handling • Training: manual and computer-aided instruction.

Retwalls determines wall thickness, footing size, steel and placement for retaining walls with direct, longitudinal and surcharge loads.

847 ROOF INSULATION
Loyd E. Winer, P. E., 2140 Rolling Hill Dr., S. E., Grand Rapids, Mich. 49506—Loyd E. Winer, 616-949-5831 (days) • For use with HP 86/86B, HP 9816 and IBM PC; requires 64k RAM and 256k disk storage • Price: $450; Updates: free • Training: manual.

Roof Insulation determines, from 26 inputs, the most economical thickness of roof insulation for its life cycle.

848 SCADA
American Computers and Engineers, 2001 S. Barrington, Suite 204, Los Angeles, Calif. 90025—Aziz Al-Khal, 213-477-6751 • For use with any computer using the CP/M or MS-DOS operating systems; requires printer, plotter, CRT and 64k RAM • Price: $9,100 also available as part of a turnkey system; Updates: free during first year, billable thereafter • Training: seminars, in-house, on-site, manual and computer-aided instruction.

Scada is a finite element analysis program that statically and dynamically analyzes two- and three-dimensional structures comprised of beam and truss elements together with elastic plane, plate and brick elements. Provides a display of the structure on either a plotter or terminal for visualization of the output and model verification.

849 SHERWALL
J. J. Jordan, Architect-Engineer, 5236 Overbrook Way, Sacramento, Calif. 95841—Jim Jordan 916-332-6610 • For use with IBM PC, PC-XT or compatibles, one disk drive and a printer or TRS-80 1, 3 or 4, one disk drive and a printer; requires 48k RAM • Price: $76.83 for TRS-80; $97.83 for IBM PC (one-time license fee); Updates: $8 plus materials and handling • Training: manual and computer-aided instruction.

Sherwall determines foundation loads, seismic loads and shear, shear panel material, nailing schedule and hold down requirements for each panel and wall.

850 SITE ENGINEERING
Computervision Corporation, 100 Crosby Dr., Bedford, Mass. 01730—Ben Smith, 617-275-1800 • Software is available only as part of a turnkey package, which incorporates Computervision CDS 4000 equipment • Updates: billable or included with maintenance contract • Training: in-house, manual and computer-aided instruction.

Site Engineering provides the capability to convert conventional survey input or a tracing of a predrawn plan into a digitally modeled representation of the site. Using digital terrain modeling techniques, profile, cross-section and alignment drawings can be created. Also, earthwork calculations can be determined. Requires *General Mapping*.

851 SITE PLANNING
Intergraph Corporation, One Madison Industrial Park, Huntsville, Ala. 35807—Al Kemper, 205-772-2000 • A basic turnkey system consists of one computer workstation, hard printer, plotter and software. Systems are based on DEC-VAX and PDP-11 computers • Price: Turnkey package with software starts at $120,000; Updates: free with service/maintenance contract or billable • Training: in-house, on-site implementation plan; computer-aided instruction and manual.

Site Planning is terrain modeling software for modeling and analyzing land surface characteristics. The software supports drainage studies, cut and fill calculations and other functions essential to the site planning process.

852 STEEL DETAILING PACKAGE
Computervision Corporation, 100 Crosby Dr., Bedford, Mass. 01730—Ben Smith, 617-275-1800 • Software is available only as part of a turnkey package, which incorporates Computervision CDS 4000 equipment • Price: N/A; Updates: billable or included with maintenance contract • Training: in-house, manual and computer-aided instruction.

Steel Detailing Package automatically creates details of standard hot-rolled sections and connections according to specified standards. American and Australian standards are provided.

853 STORMWATER
F. J. Rospond Associates, Inc., 395 Franklin St., Clifton, N. J. 07003—Anthony Mascia, 201-429-9888 • For use with HP Series 80 computers; requires 32k RAM and printer • Price: $500; Updates: free • Training: manual and computer-aided instruction.

Stormwater is used to design storm sewer networks by the rational method. Rainfall based on most intensity/duration/frequency curves. The user may enter/edit and/or store design data and calculate results for any completely defined pipe at any point in the input process.

854 STRUCTURAL ANALYSIS BY FINITE METHOD
J. P. Axe, I. D., 1429 Crownhill Dr., Arlington, Texas 76012—John R. Axe, 817-277-2055 • For use with IBM PC and compatibles (Compaq and Eagle), TRS-2000 and TRS-80 Models 3 and 4; requires two disk drives • Price: from $394.95; Updates: free or billable depending upon complexity of update • Training: manual and sample problems.

Structural Analysis by Finite Element is a finite element program that can analyze a variety of structures. The basic program consists of a data editor, a frontal wave-type solver and finite elements selected to meet the needs of each user. Elements include plane truss, space truss, constant-strain triangle and rectangular plate.

855 SUNGRAPH
Solartek, RD, No. 1, Box 255A, West Hurley, N. Y. 12491—Dean Stockwell, 914-679-5366 • For use with TRS-80 Models 1, 3 and 4; Apple IIe and II+; IBM PC-XT and PCJr. • Price: $49; Updates: none required • Training: manual.

Sungraph calculates and graphs the sun's position in the sky (local elevation and azimuth) at any location on earth. Program options include graphs or tabular output of elevation vs. time of day, maximum elevation vs. date and elevation at a specified azimuth vs. date.

856 SUNHEAT 1
Solartek, RD, No. 1, Box 255A, West Hurley, N. Y. 12491—Dean Stockwell, 914-679-5366 • For use with TRS-80 Models 1, 3 and 4; Apple IIe and II+; IBM PC-XT and PCJr. • Price: $49; Updates: none required • Training: manual.

Sunheat 1 is an interactive program that allows users to configure and evaluate solar hot water heating systems. Calculates how much solar energy a solar hot-water system can collect and use relative to total requirements.

857 SUNPAS/SUNOP
Solarsoft, Inc., 1406 Burlingame Ave., Suite 31, Burlingame, Calif. 94010—Christine Ashton, 415-342-3338 • For use with Apple 2, 3, Lisa and IBM PC • Price: $400; Updates: free for first six months, billable thereafter • Training: manual and help screens.

SUNPAS/SUNOP calculates over-all heating and cooling loads of residential and light commercial buildings and includes passive solar analysis. Also analyzes effects of sunspaces, Trombe walls, water walls, and glazing, shading and insulation configurations. *SUNOP* performs an economic optimization of possible conservation and solar levels.

858 TSWING/SOLGAIN
Solarsoft, Inc., 1406 Burlingame Ave., Suite 31, Burlingame, Calif. 94010—Christine Ashton, 415-342-3338 • For use with Apple 2, 3 and IBM PC • Price: $400; Updates: free for first six months, billable thereafter • Training: manual and help screens.

TSWING/SOLGAIN predicts temperature swings in a building on a zone-by-zone basis. Helps designer place solar apertures and thermal storage mass. *SOLGAIN* is a solar radiation routine based on reflectance and adjustable overhang modifiers. Features cross-sectional graphics of direct beam penetration.

Index

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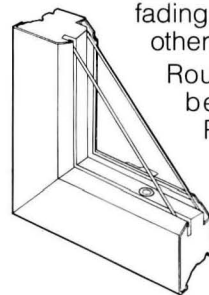
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Architectural education: "There is an urgent need to reduce or eliminate the dominance of the studio"

By Amos Rapoport

Amos Rapoport is currently Distinguished Professor of Architecture at the University of Wisconsin-Milwaukee, where he was formerly Professor of Architecture and Anthropology, and Research Professor. He has taught and lectured throughout the world, and was the 1983 Sir Banister Fletcher Visiting Professor at the Bartlett School of Architecture, University College, London. He is editor of Urban Ecology, *associate editor of* Environment and Behavior, *and is the author of eight books, including* Human Aspects of Urban Form, *and* The Meaning of the Built Environment. *He is an associate of the* RIBA, *and a Fellow of the Royal Australian Institute of Architects.*

The following remarks may be seen as heretical since they question the most central characteristic feature of architectural education—the design studio. In doing so, two distinct aspects need to be examined: first, what is taught—the rationale, theory and subject matter; and second, how is it taught—the manner of teaching.

Although my major objective is to examine critically how it is taught, it is essential that the other aspect be addressed briefly. In doing so an even more heretical position will need to be adopted: I will be asking highly critical questions about design and its central role in architectural education. In effect, questions are raised about what it is we do—and should do.

Design should be based on theory, not likes and dislikes

The nature of design is something about which I have had various things to say over the years.[1] The essence of my argument has been that the purpose of design is to provide settings appropriate to the bio-social, psychological, cultural and other characteristics and needs of the different people for whom design is being done. This means that the most important decision is *what* to do and *why* to do it rather than *how* it is to be done (which comes later), with which design has traditionally been more concerned. (I neglect, for purposes of this discussion, issues such as how much design should be done—the minimum rather than the maximum—the degree and nature of open-endedness, and questions of participation.)

Furthermore the decision about what to do and why must be based on the best available information, on a body of literature, on research on man-environment interaction, on theory rather than the likes and dislikes of designers. In fact I have argued that in its strong form this position may involve designing something that the designer dislikes or even detests.

In setting explicit objectives for design, criteria are also set for evaluating how successfully goals have been met. When this process is repeated, there is hope of developing a cumulative body of knowledge and theory.

At the moment architectural design is the best example of what Sorokin called the New Columbus Syndrome: the tendency to rediscover America anew each time, or to reinvent the wheel.

It seems self-evident that both design goals and criteria of evaluation are always necessarily related to, and dependent on, a theory; one needs first to know what built environments can do before one can assess whether any given specimen does it well or badly.

Yet there is no valid theory of design involved in design teaching. In fact there is no theory of design worth that name. Without such a theory, design cannot be taught and is not really suitable as a university subject. Its approach is personal, subjective, illogical and not cumulative. One can also argue that it should not be taught since it perpetuates a highly undesirable state of affairs.

What to do should be stressed over how

As an illustration consider a recent study that seems to support my criticisms. This study deals with decision-making in architectural practice. It examines the relative allocation of time to the different stages of projects.[2] From this study it seems quite clear that the question of *what to do* receives least attention—the initial idea is developed rapidly using little information and research but it also rarely changes much. This fundamental decision is based on the designers' decision experience which, they believe, is best obtained by *doing* one's own design. Most time is devoted to refinement, minor matters of detail, small changes, choosing materials; in other words, the stress is on the *how*.

The teaching of design tends to perpetuate this manner of working. For example, a recent article comparing architectural design to music points out that the skills and knowledge assumed to be necessary for design are sketching, drawing, construction, planning, detailing and modelmaking.[3] None of these helps to deal with the question of what to do.

The result of this teaching approach was summarized well in a recent book review where an unnamed "leading publicist of postmodern architectural theory" is quoted as saying that "architecture is comprised of behavior, environment and form. Since I know nothing about environment or behavior I will restrict my discussion to form." The author comments that "such know-nothingism is inexcusable."[4] Yet unfortunately, such "know-nothingism" is the norm in design as it is done, and is a result of design as it is taught; the two are intimately linked.

That design is the principal thing is not self-evident

Let us assume that not all design taught is as bad (in my terms) or that, by some miracle, it has changed overnight into a genuine body of theory and knowledge. The question would still remain: how is that new design to be taught? The

studio basically sees design purely as a craft approached subjectively, stressing the personality of the designer rather than ideas (this is of course typical of architecture generally).[5]

In effect the studio presupposes that apprentices learn from a master—it perpetuates the archaic master-apprentice system no matter how disguised. This has several problems. Lacking clear evaluative criteria, there is no way of defining who is a "master," what constitutes mastery, or what one is master of. This system also nullifies what I think design should be and the essence of university teaching—a stress on ideas, theory and knowledge rather than personality, for example.

It also perpetuates the emphasis on one's own experience and resources (as described in the BRE study cited above). But questions about the studio format go beyond even these questions, which I will now examine.

It is implied in the central position of "design" in architectural education—and reflected in the amount of time and resources devoted to it in studio teaching—that "design" (however conceived) is the principal thing architects do—and hence should know. This is far from self-evident, and I suspect that a study of how architects spend their time would reveal otherwise. Certainly it seems evident from my own experience and observation that architects spend more time doing various sorts of analyses, in meetings and writing reports, so they need skills to help them do all this.

A whole range of new disciplines is needed

This conclusion was also reached recently for engineers. A survey of engineering graduates in major firms in Britain showed that their main weaknesses were in writing reports, in researching arguments, in a lack of language skills such as their reading ability, and in handling meetings. (It should be stressed that, unlike architectural design, engineering design has a greater body of theory, so engineers are likely to have an inadequate grasp of theory.) It was concluded that engineers needed skills in other disciplines.[6] Architects need corresponding skills and, if my view of design is correct, they also need knowledge of a whole range of new disciplines.

Too much time is wasted in studio teaching

Most of us who have gone through years of design studio, and who might even have taught it, know how much time is wasted in the *Continued on page 103*

"The studio is where a professional architect learns to make judgments"

By Robert M. Beckley

Robert M. Beckley, AIA, holds degrees in architecture from the University of Cincinnati and the Harvard Graduate School of Design, and is a registered architect in Illinois, Wisconsin and Ohio. He's a principal of Beckley/Myers Architects. Professor Beckley began his teaching career in 1963 at the University of Michigan and, in 1969, moved to Milwaukee to help establish the School of Architecture and Urban Planning at the University of Wisconsin-Milwaukee, where he has served as chairman and acting dean. He is a member of the Chicago Architectural Club, and has been elected to serve on the boards of the ACSA, as treasurer, and the Wisconsin Architects Foundation.

Debate about the value of the design studio in architectural education is a time-honored tradition amongst architectural educators and practitioners. Amos Rapoport, a friend and colleague, has again raised serious questions about the role of the design studio in architectural education.[1] His arguments reflect the concerns of others and deserve to be addressed.

Of course an attack on the methods of teaching design raises questions concerning design itself. It would be easy to launch a counterattack on Rapoport's accusations concerning a lack of discipline in design theory and practice by preaching about the failures of lecturers and lecturing, but this would only resume the rhetorical debate between designers and academics that becomes rather boring. Since Rapoport's arguments might reflect the concerns of others, let us see if new light can be shed on this subject of design and design education.

Design quality separates architects from builders
What is design? If we use the dictionary as a source we find the word has multiple meanings. They range from the subjective "to designate" to the objective "to plan mentally, to outline, to scheme." It is the latter definition that gained popular usage with the advent of scientific inquiry and that was the approach championed for architecture as it took on problems of significant social and political consequence. Architectural design has been criticized if it does not adhere to the rigors of scientific methods of inquiry regarding the nature of "the problem." Design is seen in pragmatic terms. Architectural design cannot deny that it is pragmatic. Buildings are built for a purpose, they are supposed to *do* something. On the other hand we are told that architects are to be trained in the art as well as the science of building. Firmness, commodity *and delight* were the trinity of challenges given architects by Vitruvius. Architects are expected to provide delight. It is perhaps this provision alone that separates architects from builders and engineers. An honest appraisal of architectural design must accept that the architect is responsible for both quantifiable and qualitative performance—for scientific as well as artistic objectives.

In the other sense of design, returning to our abbreviated definition, the designer is a designator. At this juncture we introduce the problem of designer "ego" that bothers Rapoport so very much. The problem of ego is associated with any profession, given a society where specialized knowledge is accepted as necessary. Within any profession one can find an individual's imprint on his work. The designer's role, as with any good professional, be they lawyer, doctor, musician, artist, is to put a little of themselves into their work. Even in so-called primitive societies, which may not single out individuals as designers, it is usually apparent that certain individuals have more highly developed skills than others and their work embodies a certain quality or style that distinguishes their work. Arthur Danto, Johnsonian Professor of Philosophy at Columbia University, argues that... "style is the man, that while there may be various external and transient properties of a person, style at least comprises qualities which are essentially his."[2]

Qualities which are essentially his? How do we ascertain if an individual's style is essentially his? Rapoport might ask whether it is important that we be able to distinguish one designer's jeans from another's, or ordinary jeans from designer jeans. In any case the designers cannot but help interject a bit of their own style, in Danto's sense of the word, into their work.

Teachers are divided into two camps—academics and designers
In our society we have become skeptical of both scientific solutions to problems and stylistic solutions. We have seen architecture that is programmatically correct that does not touch the soul. We have seen architecture that is purely utilitarian and profers no delight. We also reject architecture that is all style and no substance. It is this challenge that design education must meet. Now how does one go about educating a designer?

A reason for a debate about the value of the design studio originates in the long-standing tradition in architectural education that separates academic teaching from studio teaching. These two aspects of an architectural education are constantly competing for a student's time. In this traditional framework of architectural education, teachers are divided into two camps—the academics and the designers. Academics lecture in classrooms and designers teach in the studio. Each camp has its pet concerns. Academics are frustrated that their theories are forgotten, bastardized or simply ignored in the studio—often, it appears, with the consent and encouragement of the design instructor. The person teaching academic courses complains that students spend too much of their time in the studio and not enough time on their academic course work. The design studio

instructor, on the other hand, complains that students have learned nothing in their lectures, that they do not know how to apply what little knowledge they may have, and that writing papers and taking tests takes too much time from their more valuable studio work. The student, of course, is the one caught in the middle of this struggle.

Architectural studio education is an innovative process
As practitioners of a modest and insecure profession, and a relatively new one from an institutional standpoint, architectural educators are not ones to think of themselves as part of an educational avant-garde. I would argue that research and philosophical developments concerning the process of education over the last 50 years suggests that architectural education is *indeed innovative* and is used as a model other educators find valuable. What makes architectural education innovative? Knowledge and action are *joined* in the students' education.

A model of education that joined knowledge and action was described by philosopher educator Alfred North Whitehead in the late 1920s. "Disinterested scientific curiosity is a passion for an ordered intellectual vision of the connection of events. But the goal of such curiosity is the marriage of action to thought. This essential intervention of action even in abstract science is often overlooked. No man of science wants merely to know. He acquires knowledge to appease his passion for discovery. He does not discover in order to know, he knows in order to discover."[3] Whitehead's words particularly apply to the educated architect who is expected to act on his knowledge. Whitehead goes on to say "... education should turn out the pupil with something he knows well and something he can do well. This intimate union of practice and theory aids both." Whitehead's views became the basis for the modern rethinking and critique of education and later research and writings that espouse an education that combines theoretical knowledge with the application of that knowledge. Because architectural education has applied that approach for more than a hundred years it has served as a model for many. Students of the '60s flocked to architectural schools because these schools practiced what "radical educators" like Ivan Illich, Jean Piaget and Jerome Bruner were espousing.[4] (Recent tendencies to return to a "classical education" are more a reflection of the failures of academic educators than it is on the integrative model of

studio, how much time is spent chatting and playing cards. Serious thought and research are needed to determine how much time is required to achieve certain objectives that are supposed to be achieved in the studio; even assuming that "design" and studio are important, we need to know how much time is needed and by how much it can be reduced without loss. I was involved several times in major reduction in the time devoted to studio work (once to half) without any apparent loss of quality (however that was judged by studio teachers).

If other skills are needed, as argued above, they will require time, most of which could be provided by using time hitherto spent in the design studio.

Another inefficiency that the design studio introduces is that it isolates students from the rest of the university, from the library and from reading and writing. In one Canadian faculty of environmental design, which brought together a number of disciplines so that they could learn from each other, the architects are conspicuously uninvolved. The reason I was given was that "studio takes all their time."

**There are many ways
of teaching architecture**
It seems to have been forgotten that the studio is nothing but one method of teaching (and learning) among many others. There is no evidence to suggest that it is effective, although of course one cannot judge since it has never been clearly stated what is supposed to be taught there.

Let us assume that synthesis is one of the things to be taught in a studio. One could first ask: does it get taught? I rather doubt it. I would argue that most studios are not even aware of the range of variables and most of what is taught in other courses is forgotten upon passing the sacred portals of the studio. Most studios certainly do not deal formally with priorities, trade-offs, integration and synthesis among the full range of variables (including, for example, those related to man-environment interaction). As the evidence quoted in the previous comments on "Design" suggests, synthesis does not seem to be learned (even if it is taught). This raises the question of whether there are other ways to teach synthesis which are more like those used to teach analysis.

One could also ask: how important is synthesis vis-à-vis analysis? The goals of teaching synthesis have never been articulated nor has its effectiveness been tested (as has the effectiveness of teaching clinical

skills in medicine, for example, which most closely correspond to "design").[7] Similarly unexamined has been the implicit emphasis on "creativity"—is it desirable or necessary? What does it mean? How is it best encouraged? At least one recent study of creativity in art argues that problem definition is much more important than problem solution, yet most studios stress the latter.[8] Similarly unexamined, as far as I know, have been the many other objectives that no doubt are implicitly present in studio design teaching. In spite of this lack of analysis most resources in schools of architecture—material, human and temporal—are devoted to it.

Yet surely such analysis, and a clear definition of goals and objectives, should precede such a major emphasis on a single method of teaching—and one as time-intensive as studio.

**A body of knowledge and
theory must be developed**
It follows from my argument in the first part of this article that at the moment design teaching is really impossible since no evaluation of design (in or out of the studio) is possible, other than the subjective "I do/don't like it."

This is not good enough and a case could be made for it to cease. At some point the circle must be broken so that ways of setting objectives, evaluating their validity, testing whether objectives have been met, developing and refining theory and building a cumulative body of theory and knowledge can be begun. The obvious place to break that circle is at the university and, more specifically, in the weakest link—the design studio. Only thus can one begin to develop ways of knowing what design is, what it should do, what environmental quality is for various people, how design successes can be judged, how one can decide how important design is, and so on. No longer can it be assumed that one can avoid defining and analyzing problems, nor can one assume any longer that the "solution" to any "problem" will be "building."

**We need a new view of
what architects are and do**
It can also no longer be assumed that the goal of architectural education is a Renaissance man—a single architect/designer. It is more likely that we need a whole range of people with different skills—hyphenated architects, as it were: architect-programmers, architect-evaluators, architect-researchers, architect-theoreticians.

The studio may be the major mechanism for perpetuating an invalid view of what architects are and what they should do.

One of the things wrong with most schools of architecture and which affects the profession is the absence of scholarship, research and publication compared to other disciplines. Part of the reason for this is lack of time—what little is done is often in one's own time. One can only do scholarly work if there is uninterrupted time for it—and that can only happen if that most wasteful method of teaching, in terms of time—the studio—is reduced. One does not have time to sit around with students, do desk crits, repeat the same thing to each student, go through project after project in juries, again repeating the same thing, and deal with trivial subjective matters that cannot be judged.

Time needs to be released for scholarship and research, but these can only flourish if two other things happen—both of which are also negatively correlated with studio teaching today. The first is that research and teaching are intimately related and, given the lack of theory, ideas and cumulative knowledge in design teaching, that link cannot usually be established. Second, the studio perpetuates the craft tradition of the staff; scholarship and research can only succeed if more academics find their place in schools of architecture. (Two things are omitted from this simplified argument. First, that there are schools where this is happening, and second, that there is still clearly room for good teachers and researchers.) Thus less emphasis on the studio seems to have major implications for other changes which will improve schools, staff, the profession and our environment.

Some schools pay lip-service to the idea that other things besides design and design studio are important, that there are other kinds of architectural skills and even, possibly, other kinds of architects. But even in those schools this is rendered ineffective because what is communicated is very different. It is quite clear to students (and staff) that design and the design studio are central, that most time is allocated to it, that the deadlines of studio projects dominate those of other courses, that resources are allocated very unequally. All these facts indicate a very different picture—that the studio is the navel of the architecture school world. In most cases, of course, there is not even lip-service given to other things. The central importance of the studio is not questioned; its role in defining the identity and uniqueness of architectural education is taken for granted.

In both these cases it is important that a different message be

communicated. I would argue that the relative importance and centrality of studio vis-à-vis other things must change. Similarly, what gives way when time is short must change. At the very least equal time and importance must be given to things other than studio. Ideally, much *more* time needs to be given to other things.

**Conclusion: too much has
been taken for granted**
I have taken an extreme position and stated it in its strongest form. I have questioned the centrality of design and argued for an urgent need to reduce or eliminate the dominance of the studio in architectural education. Consider these to be hypotheses. As such, they may be wrong—but there is only one way of deciding this. But I am unlikely to be wrong about another thing I have been stressing: the need to think about and analyze things that for some time have been taken for granted.

What is really needed is much more thought, analysis and research on how important design is (once we know what it is and what it is supposed to do), how much time it needs and merits, how much of it is to be taught in what we call the "studio," what is best taught in that way and what is best taught in other ways. This is clearly the first and most urgent task.

[1]*Amos Rapoport, "Debating architectural alternatives,"* RIBA Transactions, *March 1983.*
[2]*Margaret Mackinder and Heather Marvin, "Design decision-making in architectural practice,"* BRE Information Paper, *IP 11/82, July 1982, Garston Building Research Station.*
[3]*R. Zuk, "A music lesson,"* Journal of Architectural Education, *vol. 36, no. 3, p. 5.*
[4]*D. Watson, "Sophisticated affirmation of indigenous riches,"* AIA Journal, *May 1982, p. 68.*
[5]*Spiro Kostoff, review of* Macmillan Encyclopedia of Architecture *in* Design Book Review, *Summer 1983, p. 6.*
[6]*Peter Wilby, "Writing cramps engineers' style,"* The Times, *15.5.83. Bernard Dixon, "Say it with words,"* New Scientist 26.5.83, p. 572.
[7]*As an example see Arthur Elstein et al,* Medical Problem Solving, *(Cambridge: Harvard University Press, 1978).*
[8]*Jacob Getzels and M. Csikszentmihalyi,* The Creative Vision, *(New York, John Wiley and Sons).*

education proposed by Whitehead.)

Whatever the philosophy, studio teaching is structured
Architectural pedagogy found in use in most architectural education today has its roots in two schools, the École des Beaux Arts and the Bauhaus. At the École des Beaux Arts and the academies that preceded its formal establishment in 1819, lectures and studios were conceived as separate activities. The academy was concerned with teaching the principles of architecture and the studio (atelier) was concerned with the application of those principles.[5] The academy of old debated whether beauty was absolute or capable of change. Still it could be agreed that certain things such as proportion could be learned by studying the classical orders. These absolute beliefs taught in the academy made it possible for the student to unambiguously apply the academic's theory in the atelier.

The Bauhaus kept the distinction between the academic and design teaching methods of the Beaux Arts. It disagreed on the content of knowledge transmitted in the academy and the role of the studio teacher, however. The role of the design teacher was to be as "stimulator," students were not expected to imitate their design teacher or to develop solutions based upon clearly established precedents. Students were expected to experiment with their own solutions to design problems.[6] The reasons for this were clear to the Bauhaus educators. They saw new building types emerging for which they saw no precedent.

Today's design instructors are likely to be of one of these two schools. (There are some design educators who may use both the absolutist approach and the experimental approach in their studio, depending upon the level of student being taught, the nature of the problem, etc.) While there is still great diversity in the education of architects, the tradition of separating academic education from design instruction remains a common element in nearly every architectural program. Why?

The answer to that question can be found by looking at what happens in the design studio. It is quite different from what happens in an academic lecture to be sure. The "style" of individual design studio instructors may vary greatly just as there are variations in style among lecturers. There is, however, a working pedagogy used in the design studio, it is Socratic. Designing, says Donald Schon, "takes the form of a reflective conversation." In Schon's terms, the language of this conversation combines drawing and speaking.[7] The design studio is the place where this methodology is transmitted. To the person looking for a sophisticated teaching method, this approach seems archaic. To the person predisposed to particular solutions, the method seems time-consuming. To the person looking for the application of particular theories the process seems slipshod and inefficient. But, it is *structured*.

In the studio, the instructor is mentor and surrogate client
Let us compare the lecture course to the studio as we would compare a speech to a conversation. In a speech one makes a formal public discourse, oration, address. The professor professes—such and such to be true. In a conversation information is presented with feedback expected and anticipated. A conversation is interactive and it can be programmed. (Vis-à-vis one's dialogue with a computer.) Academic courses program students as do their non-academic experiences. The studio is the technique used to make the architectural student's information applicable to a particular problem, via interaction.

The academic mode that Rapoport espouses has its role. The student must have some knowledge of the subject to engage in Schon's "reflective conversation." In the architectural student's education there is an introduction to normative knowledge about specific "professional" issues as well as general "cultural" issues. Academic courses are expected to teach normative information concerning a wide array of subjects, including structures, materials, esthetics, energy, human behavior, history, economics, etc. The professional architect, it is assumed, absorbs this normative knowledge and then makes judgments. How does a professional architect learn to make judgments? In the studio.

But, our poor student who is still in school has not completed a normative education. Where does he or she begin the reflective conversation? What hypothesis does he test? The studio instructor controls this situation by forming a problem that will allow the student to test a *certain* hypothesis. The instructor, as problem poser, serves as both mentor and surrogate client for the student. As mentor the instructor is charged with selecting an "appropriate" problem based upon an understanding of the student's normative education and the student's ability to "deal" with the problem. As a surrogate client the instructor is the other party in the reflective conversation. As the leader of the exercise, the instructor is most likely to be the initiator of questions, and in the Socratic tradition the instructor shapes the discourse by the nature of the questions asked. If the instructor asks, "What kind of structural system are you proposing?" the student realizes that structure is an issue to be contended with. If the instructor asks, "What other solutions have you investigated for *that* problem?" the instructor has identified a sub-problem and suggests that other solutions are possible.

The studio is a place where various hypotheses are tested
Don Schon notes that most often the teacher "... reflects very little on his own reflection-in-action and it would be easy for a student or observer to miss the fundamental structure of inquiry." Actually, educational programs tend to compensate for this even if they are pedagogically different. In highly structured architectural education the normative aspects of education are usually closely programmed. Students progress through the program in discernible groups, so that an instructor is likely to know exactly what academic courses students in a particular class have taken. There is usually not much shifting of instructors in this kind of program so that an instructor has time to test whether or not a particular "problem" works and certain hypotheses become a part of the studio syllabus. In loosely structured architectural schools the instructor is free to develop a "personality" and students are free to choose from amongst several faculty the courses they wish to take. Students know the instructors and the hypotheses each instructor prefers—hypotheses such as, the key to good design is structure—response to human behavior—the shaping of three-dimensional space—the use of historic precedent, etc. (More knowledgeable students with flexibility of choice will often select a school for certain normative areas where the school has strengths.)

The studio produces people capable of solving problems
Studio instruction has a number of places where it can fail for individual students or even groups of students. Studio instruction today is severely tested by students with a wide range of cultural experiences. Even in a highly structured curriculum it is not unusual to find students with a wide range of cultural experiences based on previous education, nationality, class, sex, age, race, previous occupations, places lived, etc. The studio is no more than a microcosm of the real world. A student's normative education will never be complete and it does not end when the student enters the "real world." Students from rural areas find work in urban areas, students end up becoming architects in other than their native country for brief or extended periods, etc., and they find their academic education wanting.

An architect is dependent upon rhetorical dialogue to define architectural problems more now than ever before. How does a student learn to ask appropriate questions to obtain information he or she does not have? How does a student learn to apply hypothesis testing to the ambiguous prob.ems of architecture? How does a student learn the value of using both drawings and words to establish a dialectic? How does a student learn to use the Socratic method of inquiry? The answers to all these questions lie in studio teaching.

Architectural studio education produces holistic thinkers. It also tends to produce people capable of solving problems that have not yet been identified. It tends to establish the need for academic courses and it gently softens the entrance of students into the ambiguous realm of problem solving which is the architect's unique domain. Is there room for improvement in studio teaching? Yes. Should studio teaching remain a part of the architectural curriculum? Absolutely.

[1]*Amos Rapoport, "Studious Questions,"* Architects' Journal, *26, October 1983.*
[2]*Arthur C. Danto,* The Transfiguration of the Commonplace, *(Cambridge: Harvard University Press, 1981), p. 204.*
[3]*Alfred North Whitehead, "Technical Education and Its Relation to Science and Literature,"* The Aims of Education and Other Essays, *(New York: MacMillan, 1929).*
[4]*Barry N. Schwartz, Ed.* Affirmative Education, *(Englewood Cliffs, N. J.: Prentice Hall, 1972).*
[5]*Richard Chatee. "The Teaching of Architecture at the Ecole Des Beaux Arts,"* The Architecture of the Ecole Des Beaux-Arts, *Arthur Drexler, Ed., (New York: Museum of Modern Art, 1977).*
[6]*Walter Gropius,* The New Architecture at the Bauhaus, *(London: Faber and Faber, 1935).*
[7]*Donald A. Schon,* The Reflective Practitioner, *(New York: Basic Books Inc., 1983), p. 95.*

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San Diego comes of age:
A downtown revival at Horton Plaza...
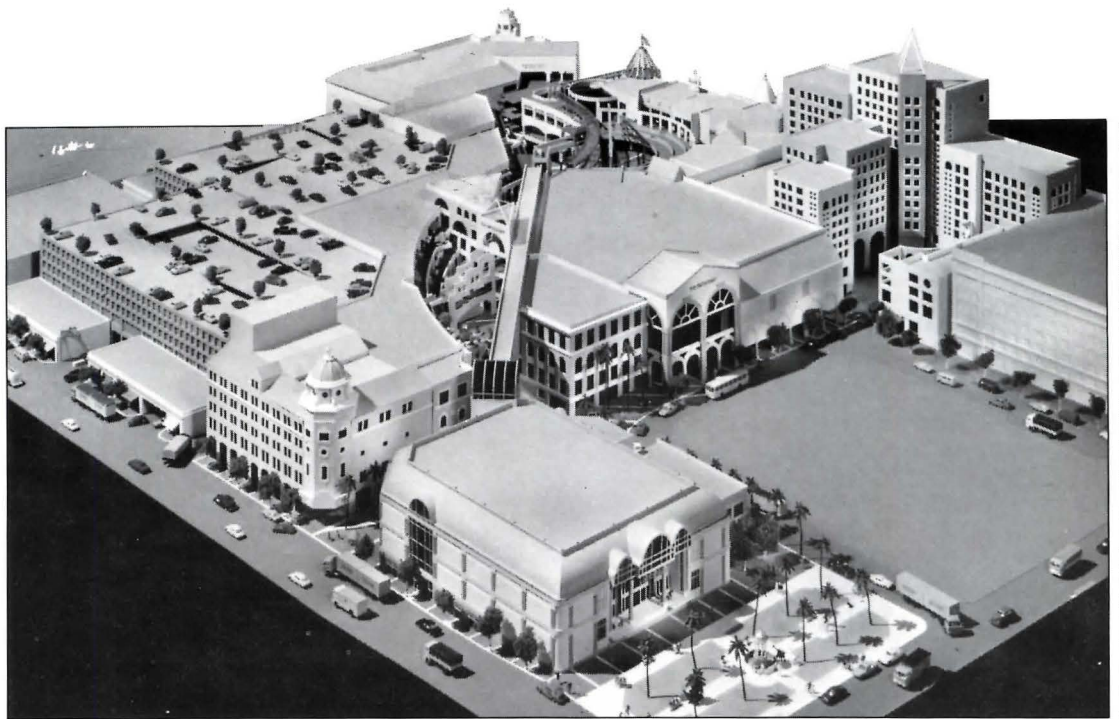
Long considered a compact, pleasantly provincial alternative to the sprawl of nearby Los Angeles, San Diego in recent years has experienced the kind of suburban growth that now threatens the city's traditional shopping district. In order to stem the tide of urban decay, the city has contracted with private developer Ernest W. Hahn to build Horton Plaza, a mixed-use downtown center now under construction on 11 1/2 acres adjacent to the historic Gaslamp Quarter. Although the 900,000-square-foot project exhibits some features that are typical of commercial centers elsewhere—namely, four large department stores, 165 specialty shops, and a 450-room hotel—the arrangement of the new buildings around bazaar-like outdoor pedestrian streets is meant to ensure "a unique mixture of retail and entertainment

opportunities," according to the developer. The design of the complex by The Jerde Partnership reflects a variety of historic and contemporary influences, including San Diego's Mediterranean architectural heritage, the festive character of the Wonderwall at the New Orleans World's Fair, and Jerde's own colorful work for the Los Angeles Olympic Games. An important adjunct to the complex is the Balboa Theater (photo left), a handsome Spanish Renaissance Revival movie house located at the edge of the development site. The theater is currently being converted into a multilevel art center that will incorporate space for permanent collections and temporary exhibitions (with an emphasis on architecture and design), a museum bookstore, a rooftop restaurant and sculpture garden, and design-related retail facilities.

... and a convention center on the waterfront

While work on Horton Plaza advances toward a mid-1985 opening, the San Diego Port District has unveiled the designs for a $95-million convention center to be located on a 10-acre bayfront site adjacent to Seaport Village and the new Intercontinental Hotel. The result of a national competition among 31 architectural firms, the center is a joint project of Deems/Lewis & Partners, Arthur Erickson Architects, and Loschky, Marquart & Nesholm. The winning design, which was praised by the competition jury for its "experimental quality and *joie de vivre*," features barrel-vaulted glass concourses, a large tent-roofed public plaza, and provisions for up to 10 rooftop tennis courts—all characteristics that acknowledge the city's temperate climate. Flag-bedecked masts and prowlike wings at either end of the 650,000-square-foot structure are obvious references to the center's waterfront location and to San Diego's historic role as a maritime capital. Completion of the building is scheduled for 1987.

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AIA National Design Conference explores the past, present, and future of San Diego

From powerhouse to funhouse: A reuse proposal for Battersea Station

If the powers-that-be in San Diego seem intent on showcasing new development in the downtown area (see preceding page), it was the city's splendid architectural past that captured the imagination of 250 architects who descended on the burgeoning border town in late August for the 1984 AIA National Design Conference. Dubbed as "a symposium on wheels," the three-day conclave was organized around visits to five significant area buildings—the Hotel del Coronado by James and Merritt Reid, the Panama-California Exhibition buildings in Balboa Park by Bertram Goodhue, the La Jolla Women's Club by Irving Gill, the Salk Institute by Louis Kahn, and the San Juan Capistrano Library by Michael Graves—that were intended to illustrate the architectural view of the world in four metaphysical tenses (past, present-progressive, present-eternal, and future). Although "Five Buildings in Four Tenses" never really coalesced as a unifying conference theme, few in atteedance seemed to mind. Architects, after all, are some of the world's most avid tourists, and everyone in San Diego appeared happiest when they were given the time to practice their photographic skills on the architectural splendors that organizers set before them.

Unlike most conferences that take place in rooms illuminated only by the light of a slide projector, the San Diego affair was a balanced mix of indoor lectures and outdoor touring. Among the many small pleasures of the well-organized event was a train ride from the city's magnificently restored Santa Fe station up the sunny California coast to San Juan Capistrano, where Michael Graves spoke in the courtyard of his new library (photo left). Graves explained how the monastery-like *parti* of the structure seemed appropriate for a library in a mission town, and he humorously noted that the most difficult aspect of building on the West Coast was the time he had to spend in Salt Lake City—"the worst week of my life"—studying for his earthquake exam.

Back in the city a rapid-fire slide presentation by Lawrence Ford, professor of geography at San

Diego State University, revealed the idiosyncratic nature of the city's architectural and landscape traditions. Ford's message was the preservation of San Diego's "urban yet woodsy" character and an appreciation of such local hybrid styles as "Egypto-Swiss," "mixed Mediterranean," and "Prairie-Portuguese." In a slightly more serious vein, separate lectures by Richard Oliver and Donlyn Lyndon served to underscore the differences between the florid Churrigueresque architecture of Bertram Goodhue, exemplified by his buildings in Balboa Park for the 1915 Panama-California Exhibition (photo right), and the planar, almost austere style that characterizes the work of Irving Gill.

Perhaps the most stirring moment of the conference came on the huge plaza of the Salk Institute in La Jolla, when Jonas Salk emerged to discuss with Charles Moore the architecture of Louis Kahn. Many in the crowd seemed deeply moved by the isolated, monastic quality of the Institute, and a slow-moving panel discussion on the building ended a bit abruptly after one member of the audience aptly noted that the Salk Institute, like much of Kahn's architecture, is a sublimely religious structure that resists easy analysis. Panels at the conference, in fact, generally were characterized by a failure of words among both audience and participants. One discussion in particular that sought to determine whether San Diego has become a "world-class" city bogged down when everyone quickly realized that liveability, not world-class status, should be San Diego's goal for the future. What seemed obvious to many local residents and first-time observers was that rather than seek the world-class qualities—and problems—of New York, Los Angeles, and Chicago, San Diego should fight to retain its special sense of place by emulating such strong regional cities as Boston, San Antonio, New Orleans, and Seattle. Clearly facing a crossroads in its development, San Diego has much to lose if it allows itself to get caught up in the destructive boosterism and unbridled growth that afflicts so many other Sunbelt metropolises. *P. M. S.*
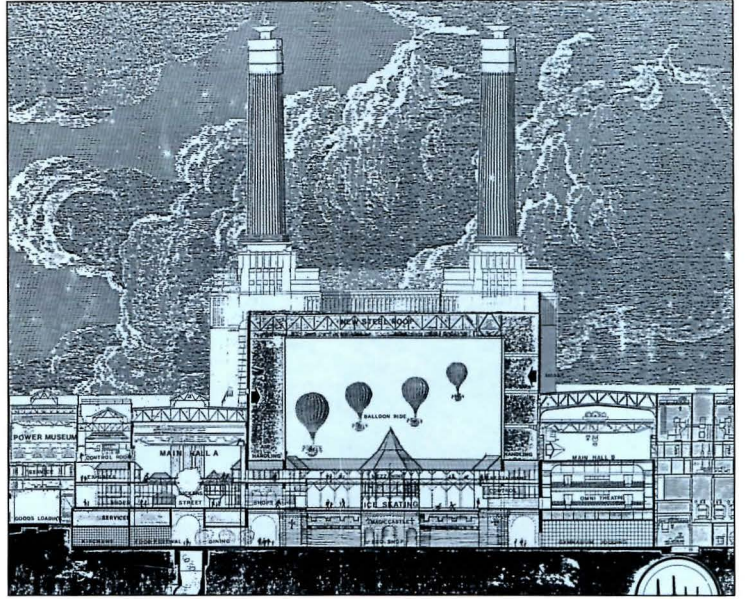
When London's Battersea Power Station was opened in 1933, the massive brick structure with chimneys at each corner was heralded as a "Temple of Power" by local newspapers. It dominated the Thames River skyline, and its interior had an ecclesiastical air. Sir Giles Gilbert-Scott, architect of the imposing structure, had decked out the huge turbine hall with terrazzo floors and paneled its control room in Italian marble.

Now plans are being drawn up to convert this landmark of industrial architecture into a "Temple of Leisure"—a "theme hall" and center for sports and entertainment—by a consortium that won a competition to find a new use for the plant. (The plant's operator, the Central Electricity Generating Board, had deemed the facility to be obsolete in March of 1983, but was prevented from demolishing it by the government.)

The idea for a leisure center came from C. Mark Leslie, an architect whose house overlooks the dramatic site and who manages the London office of Peter Legge & Associates. Sir David Roche, a London developer, took up Leslie's proposal and formed a consortium of his own company and Legge, together with merchant banker Morgan Grenfell & Co. and contractor John Mowlem & Co. Much of the competition entry was produced by Leisure and Recreation Concepts, a Texas firm brought in to carry out a feasibility study by British theme park operator Alton Towers Ltd. Both outfits joined the consortium, which is likely to form a special development company for the project. Six other groups demonstrating adequate financial and technical support also put forward proposals for reusing the Battersea plant. Their submissions

ranged from installing a hotel, apartments, and stores inside the shell to adapting the building as a trash-fired power plant.

Although it received the fewest votes from local residents following an exhibition of all seven contest entries, the Legge/Roche proposal impressed the competition jury and was selected as the premiated scheme in July. As part of the prize for winning the competition, the Roche consortium has been able to acquire the 30-million-cubic-foot building and its 15-acre site for the bargain-basement price of $2 million. The developers and architects are proposing a theater, ice rink, and other sports facilities for the gutted boiler room under a new 150-foot-long space-frame roof. While the location of "theme" exhibits has not been finalized, plans do call for the restoration of the turbine house and control room. Outside, the industrial scene will be landscaped, with a garden and restaurant replacing a riverside coal-handling plant.

Construction is expected to cost at least $50 million. Although the project could be completed as early as mid-1985, the opening could be much later if snags occur removing asbestos or obtaining final planning consents.
Peter Heywood
McGraw-Hill World News, London

Richard Bundy photos

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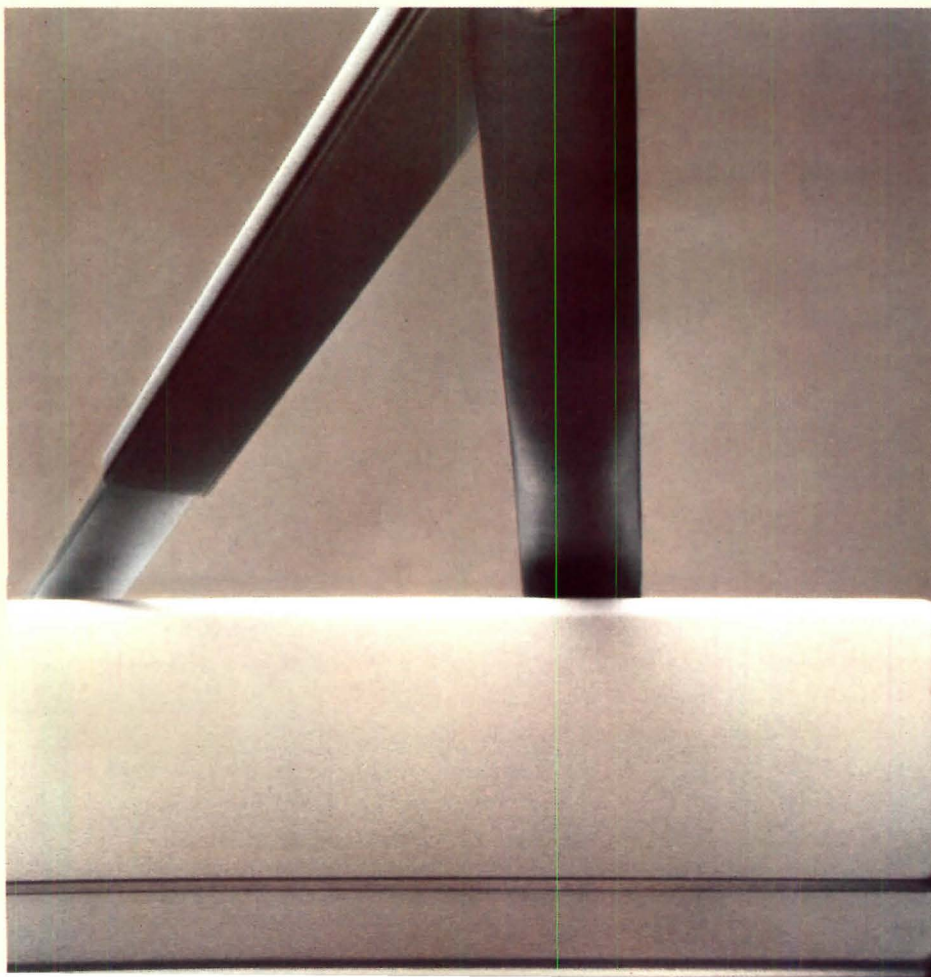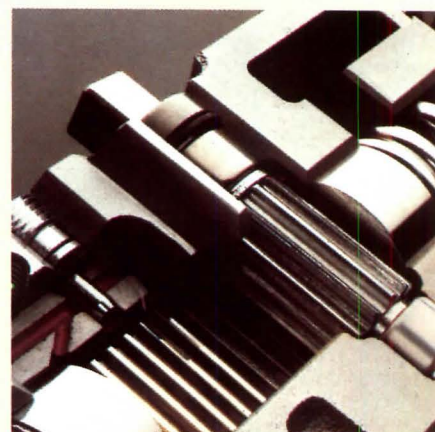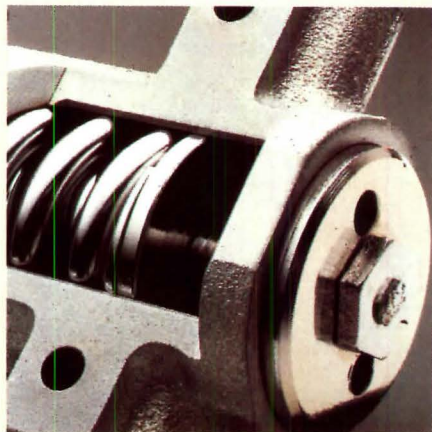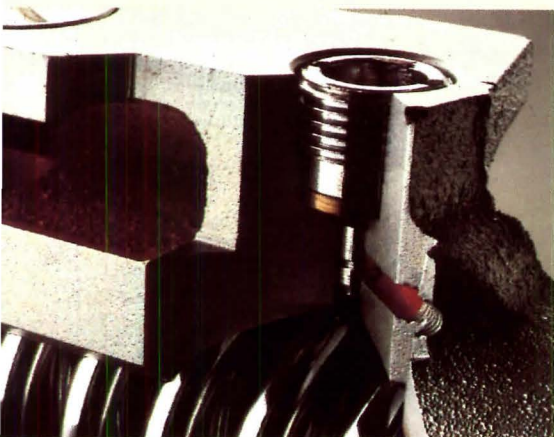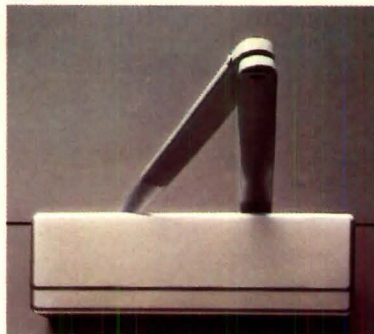
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Preserving history

Oriental overtures

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Two of the most architecturally significant buildings in the Boston area are currently the objects of feasibility studies that will serve as guidelines for future restoration. Ann Beha Associates have been retained by the Commonwealth of Massachusetts to prepare an historic structures report for the State House (1792, top), Charles Bulfinch's Federal masterpiece, as "a first step toward bringing the structure functionally into the 1980s while preserving its architectural heritage," according to a state spokesman. Beha's firm is also serving as a consultant to architects Goody, Clancy & Associates on a feasibility study for the restoration of H. H. Richardson's Austin Hall (1883, above), located on the Harvard Law School campus. Rehabilitative work is scheduled to begin in mid-1985.
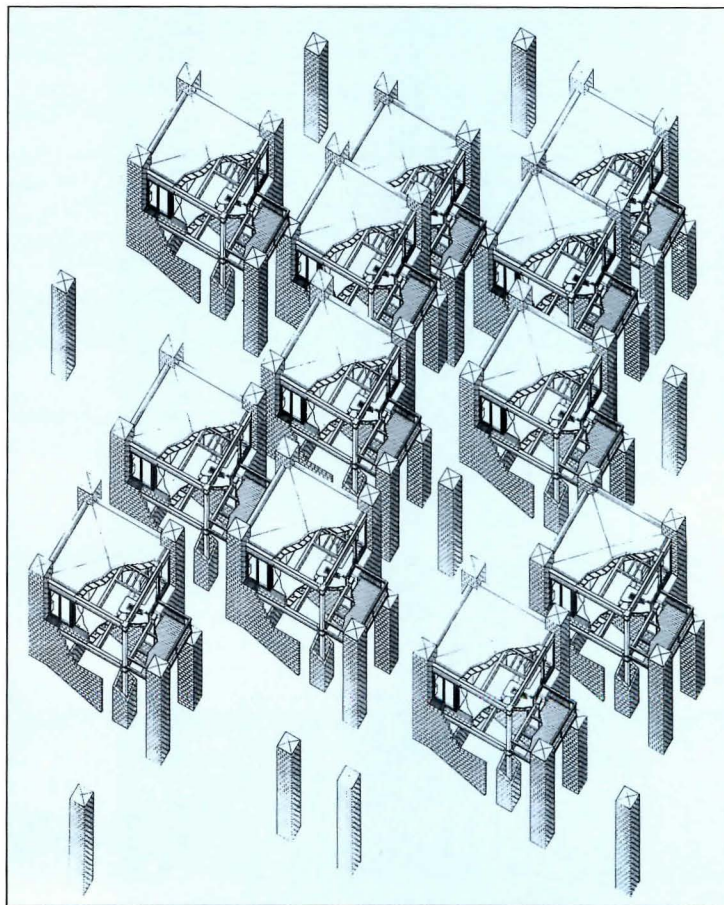
The first major exhibition in the United States devoted to the work of Japanese architect Masayuki Kurokawa will be on view until October 27 at Gallery 91 in New York City. Through the display of drawings (including the rendering shown for the Villa Ban, 1979), photographs, and examples of furniture and industrial design, the exhibition illustrates Kurakowa's philosophy that "everything in this world needs to be worked on," from sleek buildings of poured concrete to folding table systems, soft machine lighting, and metal desk accessories. Although the idea of all-encompassing design is certainly nothing new, Kurakowa's crisp, seemingly contradictory juxtaposition of geometric forms, materials, and colors epitomizes the stylistic freedom enjoyed by the current crop of Japanese architects.

Competition calendar

•The College of Architecture and Urban Studies at Virginia Polytechnic Institute is sponsoring a national "idea" competition for a new Center of Innovative Technology near Washington, D. C. Deadline for entry is November 15. Contact Paul D. Spreiregen, CIT Design Competition, College of Architecture and Urban Studies, VPI, Blacksburg, Va. 24061.
•The American Railway Engineering Association is sponsoring a student competition that seeks designs for a railroad classification yard office building and hump tower. Entry deadline is January 31, 1985. Contact Mr. D. A. Bessey, Chicago, Milwaukee, St. Paul and Pacific Railroad, Room 898, Union Station, Chicago, Ill. 60606 (312/648-3535).
•Conwed Corporation is seeking entries to two contests in its first "Creative Ceiling Awards" program. The first contest calls for entrants to design a ceiling using Conwed products. Entry deadline is February 15, 1985. The second contest calls for the judging of actual projects that utilize Conwed products. Entry deadline is September 31, 1985. Contact Conwed's Public Relations Department, P. O. Box 64237, St. Paul, Minn. 55164 or call (1-800/328-9497).

Facilities design and planning focus of 1984 Sport Summit

Now that the 1984 Olympic Games in Sarajevo and Los Angeles are history, organizers of Sport Summit, the international conference on the business of sports, are turning their attention to the construction and marketing of the 1988 Games in Calgary and Seoul. Keynote speakers at the sixth annual conference and exhibition, scheduled for November 27-29 at the World Trade Center in New York City, include Lee Young Ho, Minister of Sport in South Korea, and William H. Wardle, senior vice president of marketing for the Calgary Winter Games. Among the speakers expected to address the design and management of sports facilities in North America are David Geiger of The Geiger Group, designers of the Silverdome in Pontiac, Michigan; John Meyer of Sverdrup & Parcel and Associates, architects of the Superdome in New Orleans and Busch Stadium in St. Louis; Gerald Iffland of Iffland, Kavanagh, Waterbury, designers of the Houston Astrodome; and Ron Labinski, principal of Hellmuth Obata Kassabaum Architects. For further information and a complete schedule of speakers, exhibitors, and events contact Sport Summit, 372 Fifth Avenue, New York, New York 10018 (212/244-8002).

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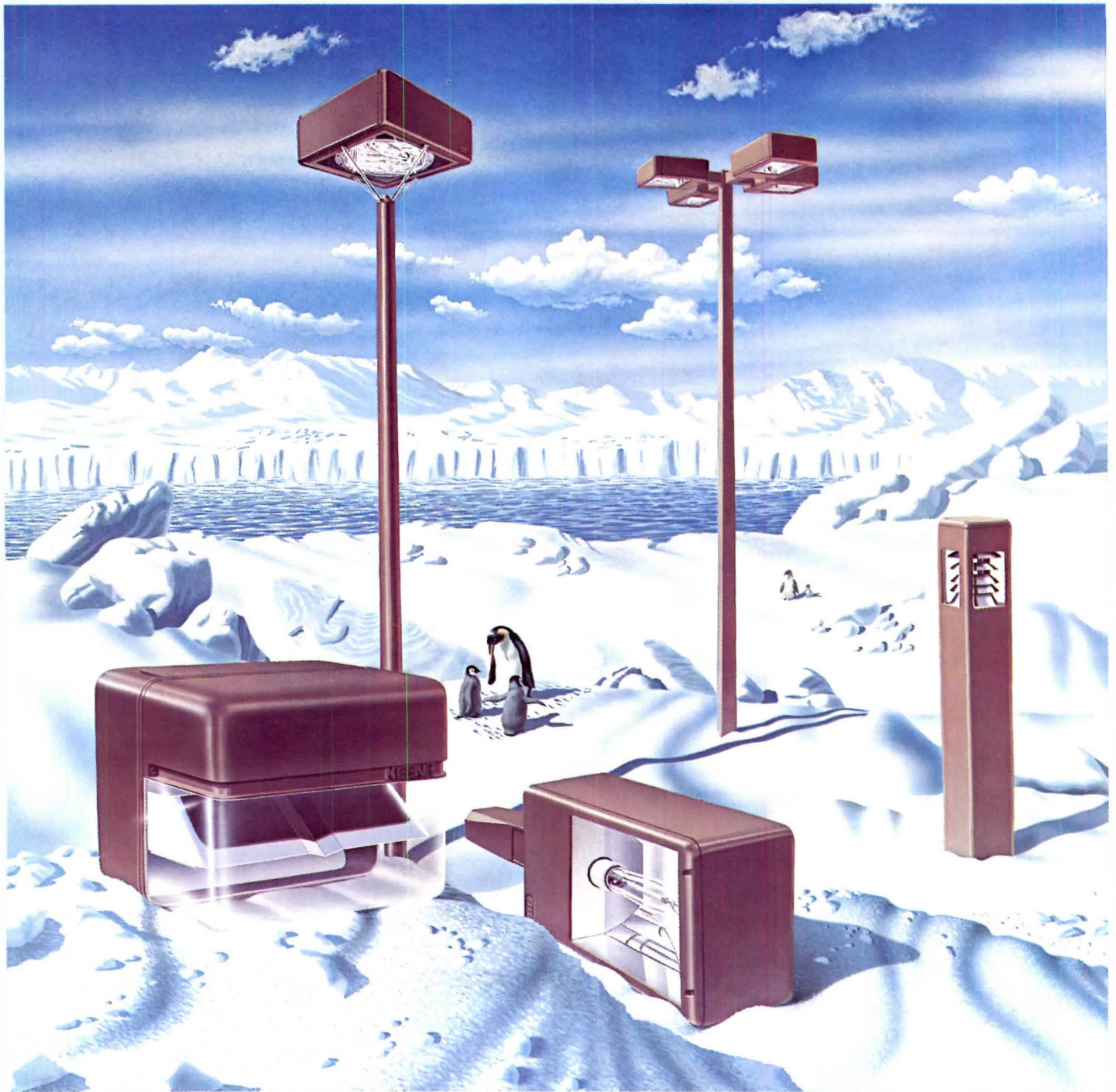
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A revitalized riverfront on tap for Detroit

Conceived as a catalyst for the revival of the Detroit waterfront, River Place is a 21-acre public and private urban renewal project sponsored by the Stroh Brewing Company that calls for the conversion of the former Parke-Davis pharmaceutical manufacturing complex into a mixed-use office, residential, and retail center. The project includes a new corporate headquarters for Stroh, developed around the atrium of a major industrial building designed by architect Albert Kahn in 1927, in addition to a new public plaza on the Detroit River and the rehabilitation of 15 brick buildings constructed in the late-19th and early-20th centuries. Future phases of the project will incorporate new office and parking structures and, possibly, a hotel. Architects for the development are James Stewart Polshek & Partners.

Sprucing up the old neighborhood

Risen from the ashes

Over the past decade cities increasingly have subsidized the development of cultural centers as a means of revitalizing inner-city neighborhoods. Ideally, these projects involve the renovation of vacant or underutilized historic structures by minority architectural firms familiar with the specific needs of the community. One such development is now taking place in the predominantly black east side of Columbus, Ohio, where architects Moody/Nolan have drawn up plans for the conversion of the old Pythian Theater and an adjacent former elementary school into a multi-use cultural and performing arts center. The two buildings, redesigned to house a 500-seat theater, a ballroom, dance studios, and classrooms, will be linked by a colonnade of dark spandrel glass ornamented with limestone.
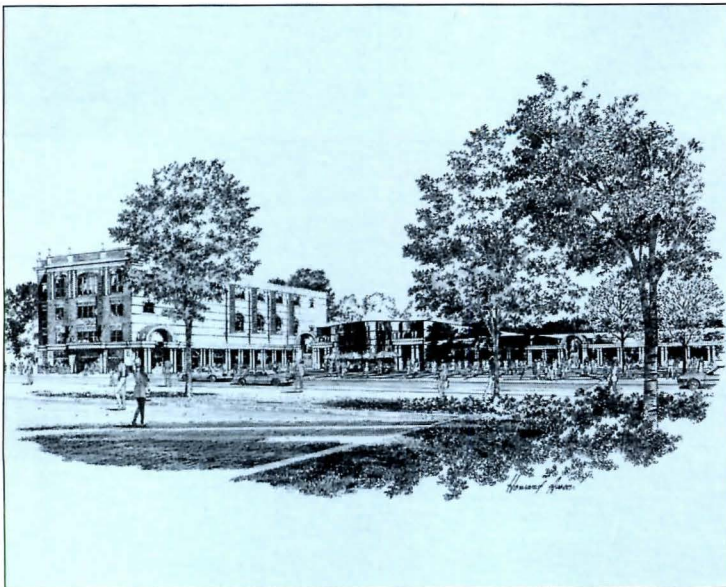
Yankee Images photo

The story of the Trapp family, the singing Austrian clan whose flight to the United States from Hitler's invading army in 1938 was popularized in *The Sound of Music*, is well known. After spending three years in Philadelphia, the family purchased an 800-acre farm near Stowe, Vermont, where they built a rustic home reminiscent of the Alpine architecture of their native Salzburg. While the family continued to tour for the next 20 years as the Trapp Family Singers, vacant space in the 27-room residence was rented out to visitors to Stowe, and the lodge was developed over time as the country's premier cross-country skiing center. In December 1980, the lodge burned to the ground, and the family once again was forced to rebuild their lives and their home. Toward that end they hired Robert Burley Associates, architects from nearby Waitsfield, to design a new 73-room main lodge and nine adjoining time-share guest houses that were completed late last year. Although the new four-story Trapp Family Lodge is built of reinforced concrete and structural steel, the architects have retained a good deal of Austrian *gemütlichkeit* through the use of steeply pitched roof planes, deep overhanging eaves, jigsawn balcony screens, and the original Trapp bell tower. And even though modern-day economic restraints dictated the simplification of many wood ornamental details, certain things—namely, the clear Vermont air, the continuing presence of family matriarch Maria von Trapp, and the lodge's pastoral setting overlooking the Worcester Range—remain the same.

SOLUTION:A
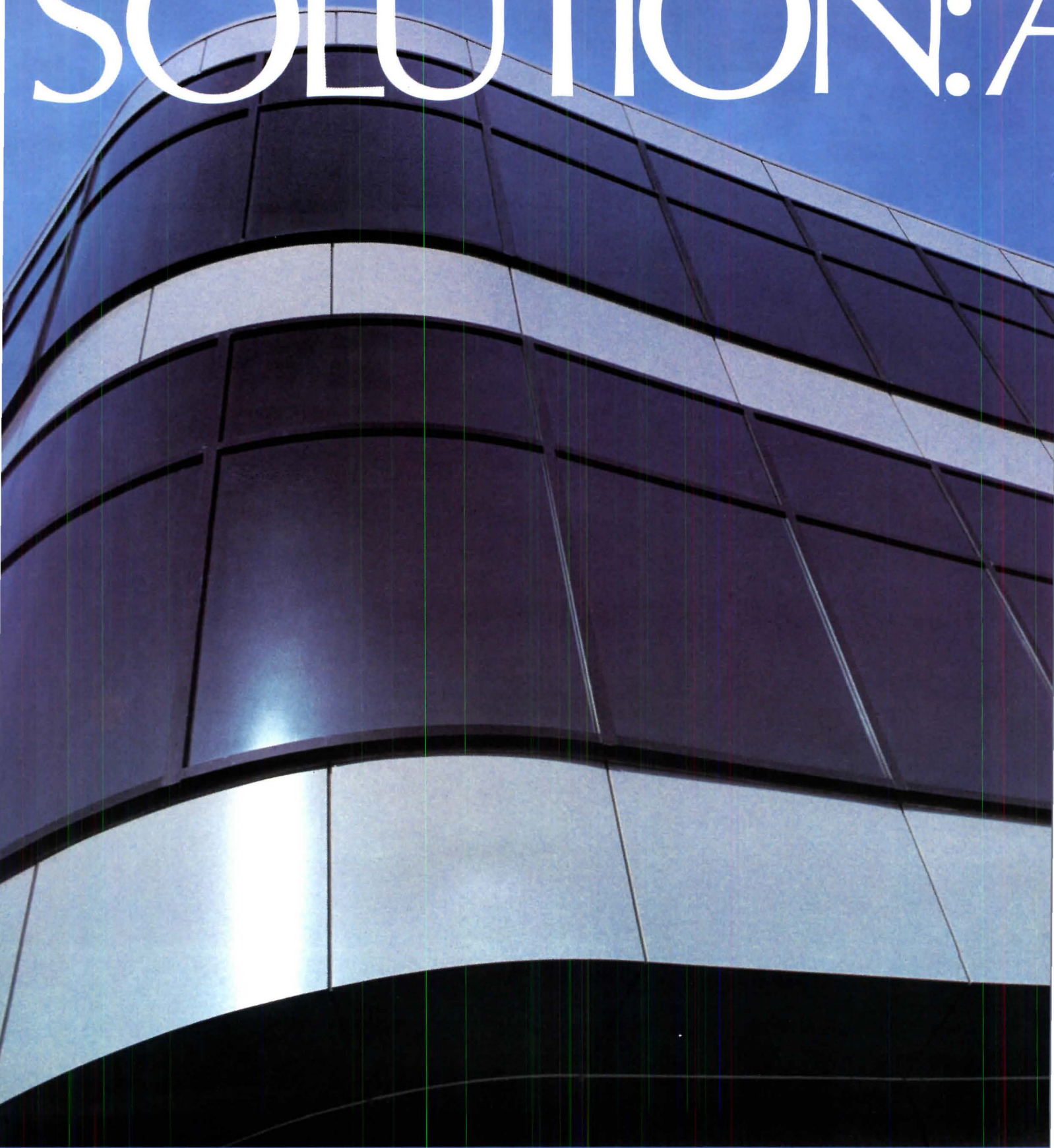
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Design awards/competitions:
Roger Williams College
Architecture Building Competition

The Providence firm of Kite Palmer Associates has won first place in a national competition for the design of a new architecture building at Roger Williams College in Bristol, Rhode Island. Ellenzweig, Moore and Associates of Cambridge, Massachusetts, and Stephen Morgan and Robin Ringwald of St. Louis were named as joint second-prize winners. The first-place entry received $30,000 and a commission to develop the design further, while the second-prize winners received $6,000 each. Co-sponsored by the college and the National Endowment for the Arts, the competition called for a
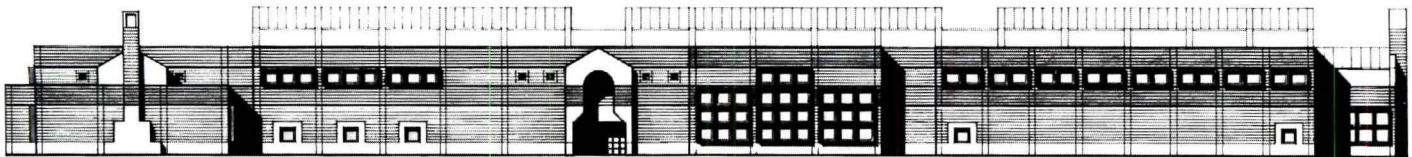
First Place:
Kite Palmer Associates,
Providence, Rhode Island

The challenge for all competition entrants was to design a facility housing a comprehensive program for architectural education in a building that relates to existing small-scale structures on the college campus—all within unusually specific guidelines that mandated a construction cost of $65 a square foot. The premiated submission by Kite Palmer Associates utilizes inexpensive materials—concrete block walls, steel floors and roof framing, and Kalwall skylights—in a structure whose 24-foot-high front elevation and 60-foot-deep setback from the street are in deference to

the modest size of an adjacent administration building. Other "contextual" characteristics of the new building (shown in elevation, above left) include horizontal bands of dark concrete blocks that are intended to tie the structure visually to the wood fascias of existing buildings; raked vertical masonry joints at column lines that relate to the expressed vertical modules found in other campus structures; and a grid of deeply set window openings that echo similar details nearby.

Entry into the building is through a walled courtyard (a feature required in the competition brief), and the plan is organized around a central skylighted gallery that serves as the facility's primary circulation spine (perspective, above right). This long corridor, bisected

horizontally by a mezzanine of faculty offices, separates design studios (shown in axonometric, top right) from support services. Although two-story-high studios were developed as one space to allow maximum flexibility for changes in student population or program from year to year, the over-all space has been modulated into five identifiable areas that are acoustically and visually divided by panels suspended between the open roof structure and drafting stations (interior view, top left). Seminar, review, and computer rooms are located in a loft within the design studio.

According to the architects, the building is meant to be "a laboratory of architectural studies"

42,000-square-foot building located near the center of the existing 80-acre campus. The structure will serve approximately 280 students enrolled in the college's five-year Bachelor of Architecture program and will house design studios, seminar rooms, a library, photo studios, a model shop, and an exhibition gallery. Jurors reviewing the 152 competition submissions were Robert Campbell, architecture critic of the Boston Globe; William G. McMinn, FAIA, dean of the College of Architecture, Art, and Planning at Cornell University; Ralph R. Papitto, vice-chairman of the Roger Williams College Board of Trustees; Michael J. Pittas, dean of the Otis Art Institute in Los Angeles; William H. Rizzini, president of Roger Williams College; Raj Saksena, AIA, director of the college's architecture division; and Bernard P. Spring, FAIA, president of the Boston Architectural Center.
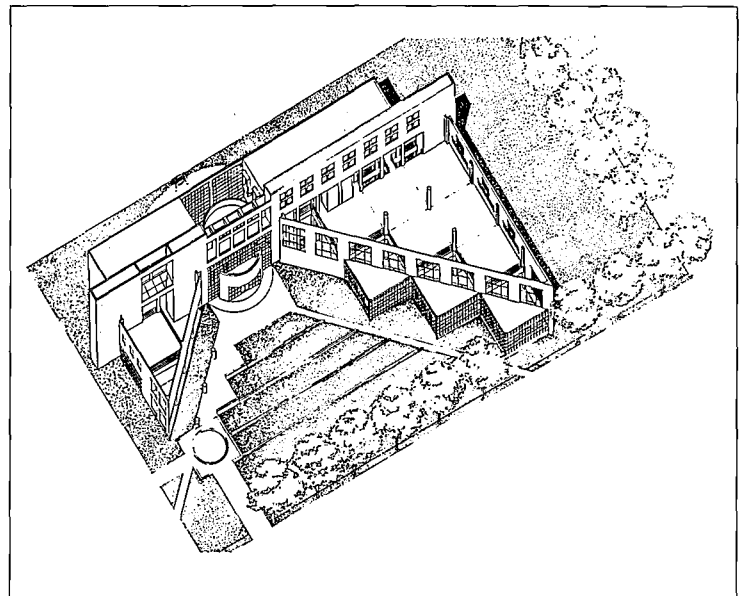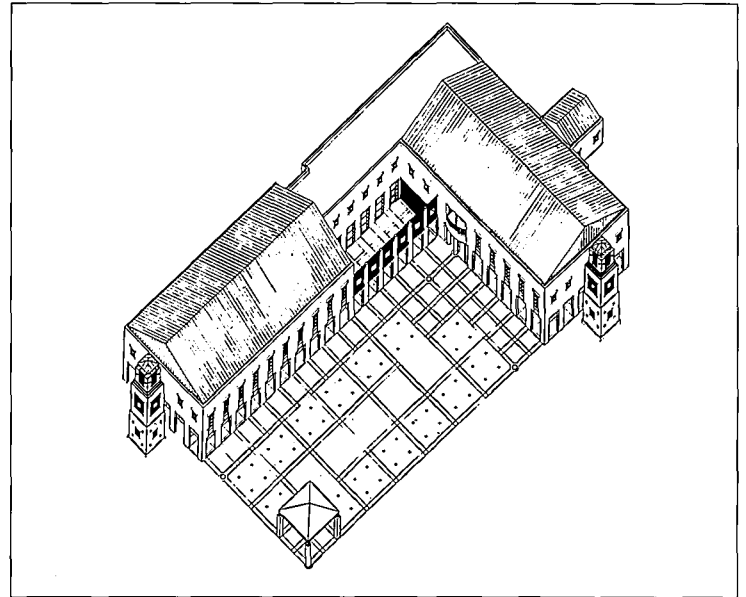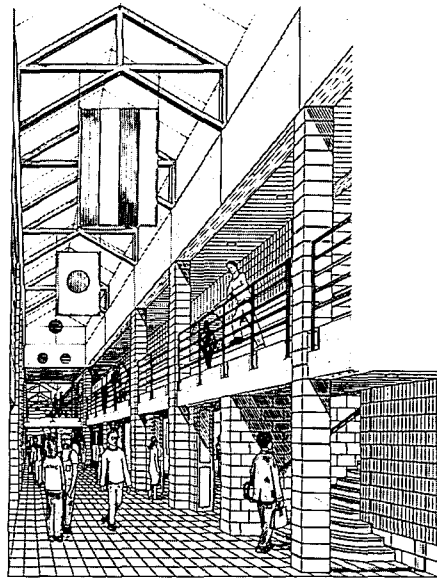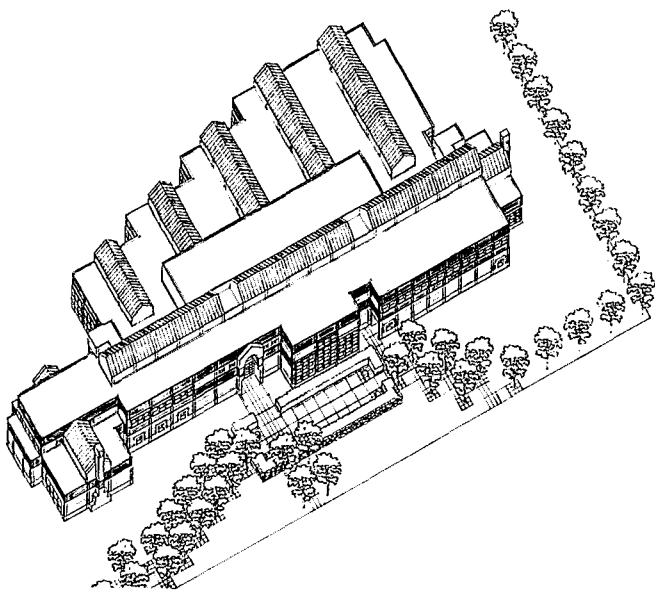
with its clearly expressed structural and mechanical systems and the readily perceived organization of different functions along the central spine. They contended that by designing high, open studios, they were attempting to provide enough space for students to construct experimental building sections and, additionally, to create "an uplifting environment in which the student may work." The competition jury obviously felt that the architects had succeeded: it complimented the design for its "extraordinary clarity of organization, the quality of the studio environment, and buildability." It added that the structure's understated character was "commendable in the over-all context of the existing campus buildings."

Second Place (tie):
Stephen Morgan and Robin Ringwald, St. Louis;
Ellenzweig, Moore and Associates, Cambridge, Massachusetts

Clearly the most historicist design among the top three submissions, the entry of Stephen Morgan and Robin Ringwald (top) exhibits such classical features as a freestanding entrance pavilion, a formally landscaped courtyard, "postmodern" stair towers, and arcades running the length of the south and east elevations. The building features walls of split-faced block and glass brick. The submission of Ellenzweig, Moore and Associates incorporates several features employed in the winning design—a long circulation spine, a centrally located exhibition gallery, and open studios laid out in a stepped configuration—but the winglike shape of the building forms a more dramatic entrance through a triangular courtyard. Sheathing of light and dark tile over gypsum curtain walls was specified for the structure.

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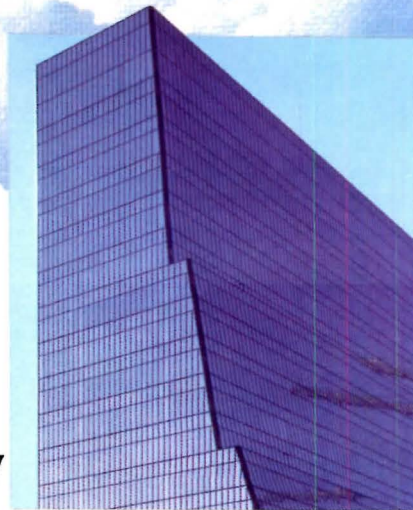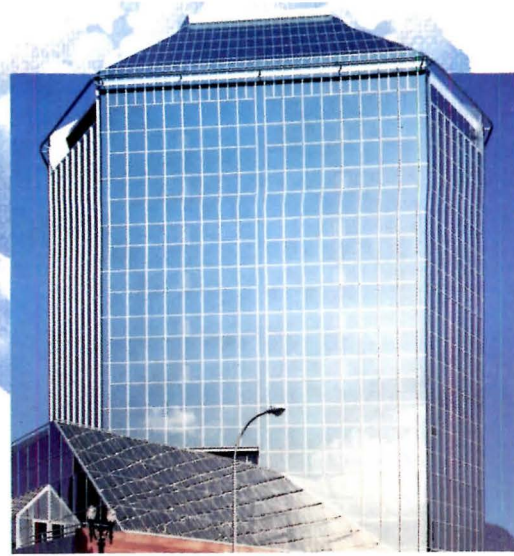
Circle 63 on inquiry card

Golddiggers of '84?

Big changes are planned for New York's Times Square. While most agree that the area needs help, the $1.6 billion proposal set forth by the New York State Urban Development Corporation has provoked a major controversy. Architect James Russell's analysis adds to the debate.
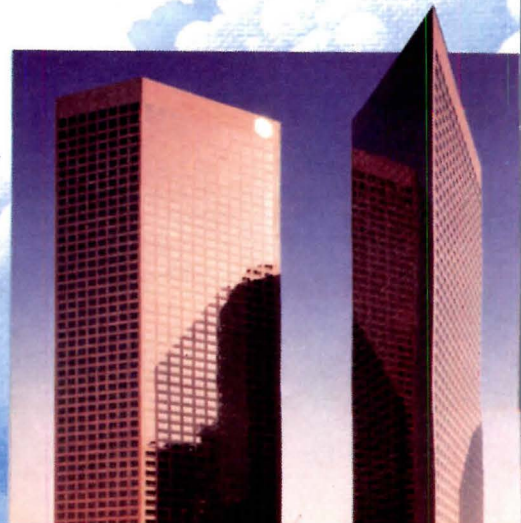
By James S. Russell

"Where is the army of New Yorkers who should be standing shoulder to shoulder in Times Square and saying, 'No! Our beloved city is not to be given away to a band of greedy profit-seekers. It belongs to us and to our children and grandchildren, and we mean to hold it in trust for them'? Let that army gather now."

That call to arms by Brendan Gill, former chairman of the New York Landmarks Conservancy, reflects a rapidly spreading awareness that profound changes in Times Square proposed by the City of New York and the State Urban Development Corporation (UDC) may destroy those qualities that have endeared the square to generations of New Yorkers and visitors from around the world.

Every large American city has had its entertainment district. The theaters, movie houses, and boardwalk-style amusements of St. Louis or Buffalo were not, taken individually, different from those found on Broadway or Seventh Avenue. But somehow these relatively ordinary elements, when thrown together on a "square" that isn't even square, became something extraordinary: a firestorm of bright lights, an exhilarating image of glamour and pleasure, a "Great White Way" known around the world. The image of Times Square today is the less glamorous and more poignant one of the 16-foot-high sultry stare and seductively open blouse of the billboard blue jeans model presiding over the more straightforward sale of sex on the street. Even the bright lights that remain are promoting mostly Japanese products.

Today, 42nd Street and the southern end of Times Square (the heart of the area's sleaze belt) are the center of the 42nd Street Redevelopment Project, an urban design scheme extraordinary in its size and complexity. Although the project site itself is small—comprising a total area of less than two average city blocks—the proposed development on that site is enormous: four office towers of 4.1 million square feet, the renovation of perhaps nine existing landmark theaters, the erection of a 2.4-million-square-foot merchandise mart and 500-room hotel, and substantial refurbishing of the Times Square subway station. The importance of the 42nd Street Redevelopment Project, however, is not simply its enormity; the

City/UDC scheme would result in the utter transformation of Times Square and the end of the area as the "rialto" of honky-tonk amusements. These would remain in the proposed development as no more than a theme, suggesting the museumization of what is perhaps most quintessentially "New York" about New York.

The unprecedented scope of the project makes it enormously risky. The major elements of the scheme—the office towers, the mart, the refurbishing of theaters and subway—are large, complicated undertakings in their own right. The financing methods are also complex, and the office tower and mart developers are required to make "contributions" to the cost of restoring the theaters and subway station. Major public investment is thereby avoided.

As the problems of Times Square have come to seem intractable, the risk of major changes in the area has seemed worth taking. The steady decline of the district since World War II has not been slowed by continued cleanup efforts or previous urban renewal schemes. Still, behind the rusting marquees and grimy draperies on 42nd Street remain the Art Nouveau glories of the New Amsterdam, the Florentine elegance of the Empire, and the Adamesque restraint of the Apollo-Times Square. Had Times Square been a "better" address, would the unique assemblage of 10 theaters still stand? As it is, the price for renewal may be high, and the fate of the theaters is still tenuous.

The formula for redevelopment of the Square was created by the city and the UDC. They hired Cooper, Eckstut Associates to pull the package together with a set of "urban design guidelines" that

would allow as many as 12 sites to be revitalized by different developers and architects. The guidelines were intended to define the scale of the elements and their relationship to the district at large. Cooper, Eckstut seemed to be the right urban design firm for the job, since the guidelines they developed at Battery Park City in lower Manhattan allowed that project to get off the ground after being delayed for over 10 years. The difference between Battery Park City and the 42nd Street Redevelopment Project, however, is that Battery Park City's landfill site was empty. The 42nd Street project requires the insertion of large-scale new elements into an existing urban fabric of extraordinary vitality and historic importance. In this kind of enormous, highly visible intervention, the role of the urban designer and architect is critical.

James S. Russell is a practicing architect with Bohlin Powell Larkin Cywinski in Philadelphia. He was formerly assistant managing editor of Oppositions *magazine.*
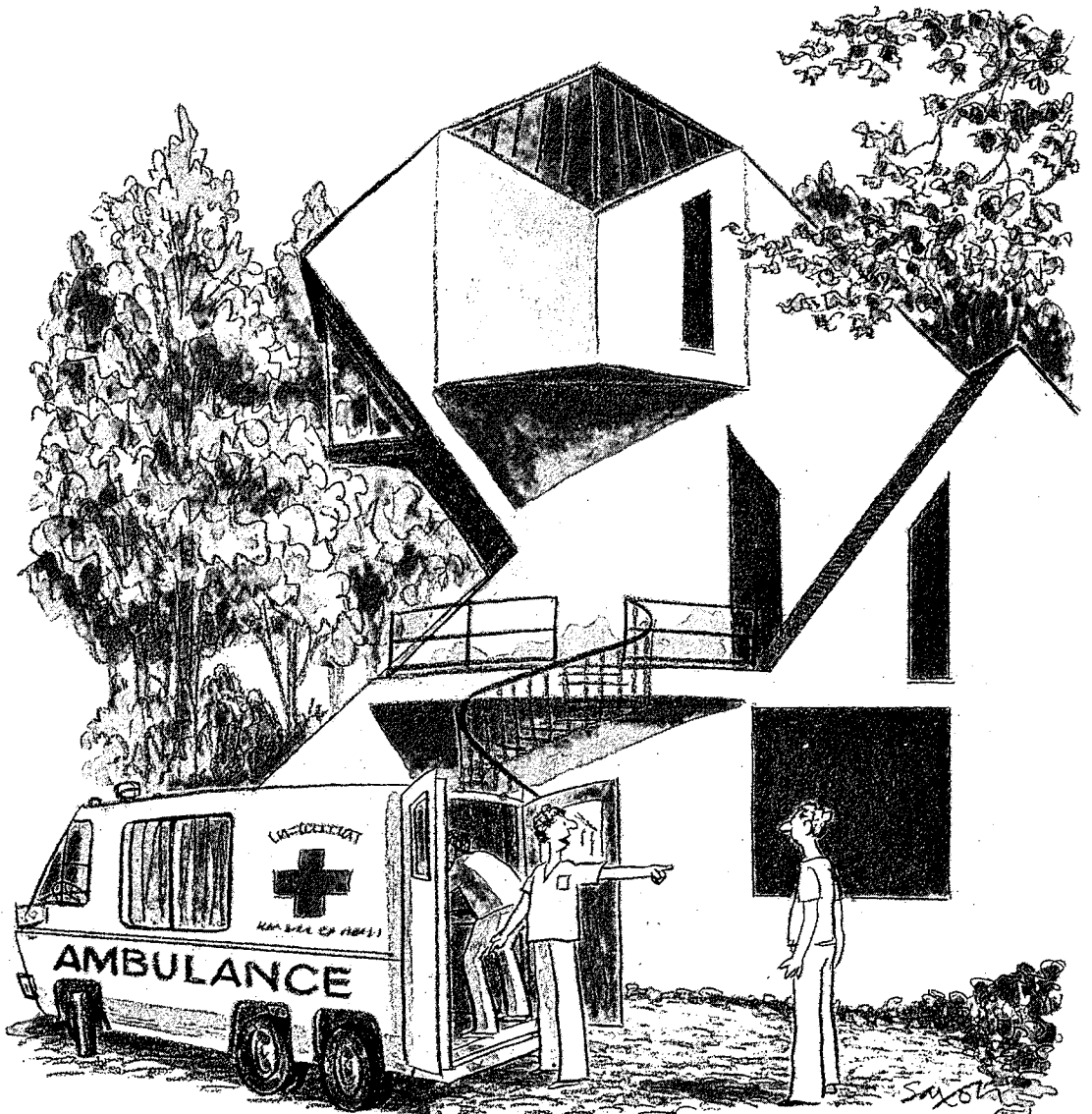
"Lapham—see if you can find a front door."

Observations

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The UDC's plans are, however, threatening to unravel. When the guidelines were first released in 1981, the plan was greeted with consistent, if not thunderous, praise. Last spring the first of the developers' schemes—the John Burgee/Philip Johnson proposal for the four office towers—was released; the project's environmental impact statement was also unveiled, but no other architectural schemes have been released. Public attention began to focus on the project as people came to see that the Burgee/Johnson towers, sheathed in cool granite and formally arranged, did not look much like the Times Square they remembered or had been led to expect. The profound implications of the project for the future of the Square began to become clear. Since then, a crop of neighborhood groups has begun to arise in protest, *The New York Times* has editorially backed off from its earlier endorsement, and the Municipal Art Society has sponsored a competition for the site of the (possibly ill-fated) former Times Tower.

The 42nd Street Development Project deserves to be examined in a larger context than that proposed by either its proponents or current opponents. As the most ambitious scheme for "contextual"

development yet attempted, it requires the integrated talents of several architect and urban design teams. After all, the focus of the project is a place close to the hearts of millions, a place layered with historical associations, a place still vital in spite of the blight that lies within its borders.

The UDC plan
The City/UDC package is not a scheme for all of Times Square or the adjacent Theater District. The project area is ambiguous, and its boundaries do not correspond to any zoning or planning district, or to any architecturally distinct area. The target region (map, page 129) covers only the southern half of Times Square and does not (as it logically might) extend all the way to the Avenue of the Americas. Cooper, Eckstut Associates have devised a scheme where four large office towers spiral around the former Times Tower on the Square and, by their massing, inflect toward the Seventh-to-Eighth Avenue corridor of 42nd Street. At Eighth Avenue the end of the project is marked by a hotel tower on the north side (elevation below) and the somewhat lower bulk of the trade mart on the south; the existing low-rise theaters fall in between. New connections are provided to the subway and the

Port Authority Bus Terminal. The heights of the existing (former) McGraw-Hill, Paramount and Candler buildings are respected in setback guidelines.

The UDC strategy of replacing blight with large-scale, intensive uses requires the 42nd Street corridor of two- to five-story buildings to be flanked at one end by the office towers that rise 35 to 50 stories, and at the other end by the 20-story mart. The mart has an enormous, essentially windowless "footprint" that stretches nearly halfway down 42nd Street from Eighth Avenue and 500 feet south on Eighth Avenue to 40th Street, creating a 300-foot-long tunnel across 41st Street. The 130,000-square-foot ground floor has 50,000 square feet of "street-related" retail space. Since the activity of the mart is self-contained (depending on the ultimate use as an apparel or computer center, it may only be open a few market weeks each year), the unrelated retail activity is meant to enliven what is essentially a giant, lifeless warehouse.

A garment center mart is opposed by many because of the depressing effect it may have on rents and occupancy in the traditional garment district nearby. The high rent such a mart would have to charge may drive some marginal industries out of Manhattan since

potential buyers may not set foot outside the mart once it is established. Another question about the mart remains: What is the compelling need for it as part of the project? It does nothing to unify the street architecturally (its massive bulk creates new problems that have to be solved, presumably by sensitive architecture), and its use is unrelated to the entertainment or retail uses being encouraged elsewhere in the project. It will, admittedly, contribute financially to subway and theater renovations.

As the other "profit center" of the scheme, the four office towers pose a more dramatic dilemma. Their density is not only enormous in the existing context; it is huge even by overbuilt Manhattan standards. The Burgee/Johnson Park Tower Realty scheme accepted by the UDC proposes almost 4.1 million square feet yielding an average floor area ratio (F.A.R.) of 35.9. By comparison, the incentives provided in the midtown zoning rules recently enacted to promote higher density on the West Side allow up to 21.6 F.A.R. on nearby sites, the citywide maximum. Even the original Equitable Building downtown, which is credited with inspiring New York's first zoning ordinance in 1916, had an F.A.R. of only 30. What are the architectural

New Office Building

Times Tower

New Office Building

New Hotel

Hotel Carter

Eighth Avenue

Broadway

Seventh Avenue

North Side Elevation of 42nd Street
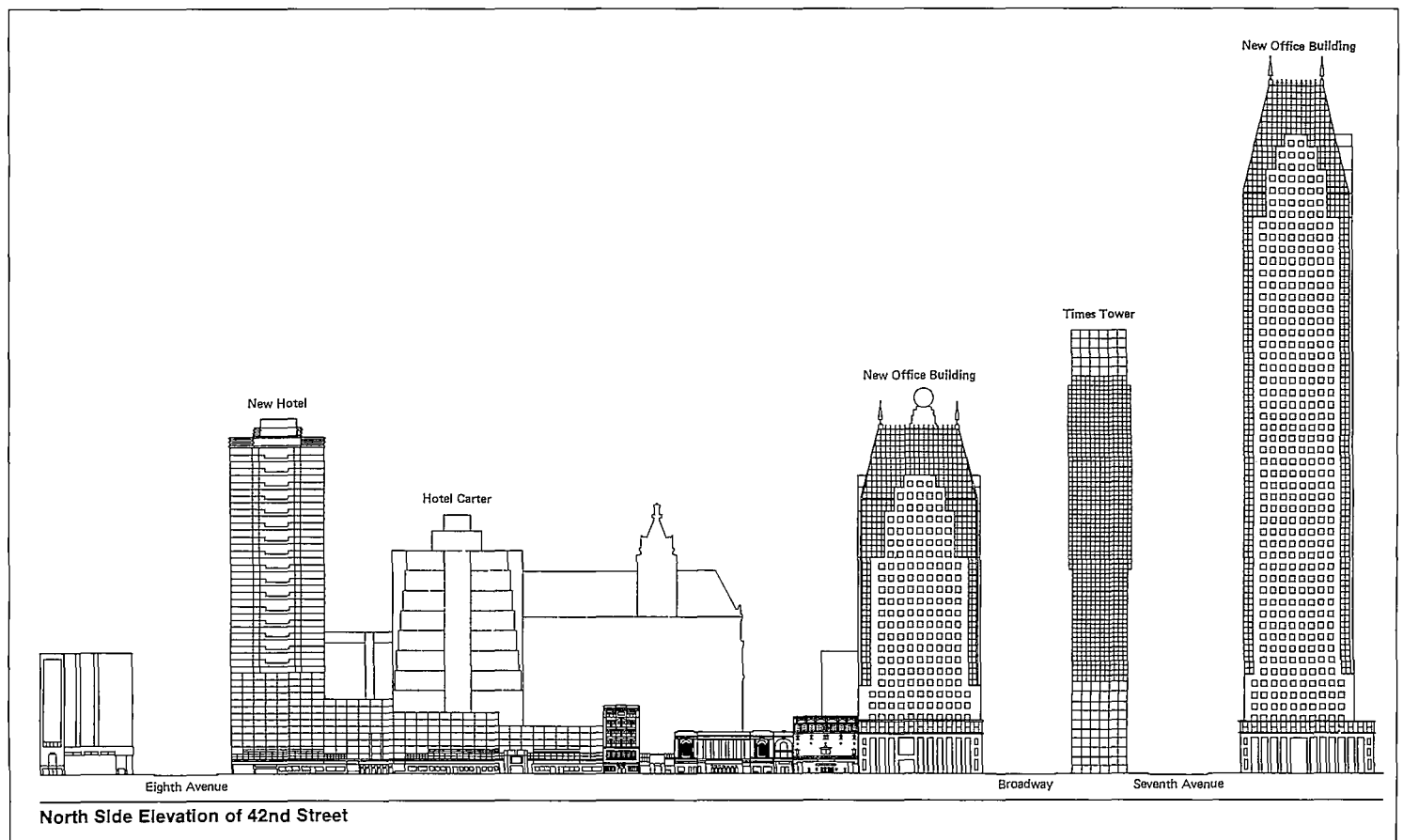
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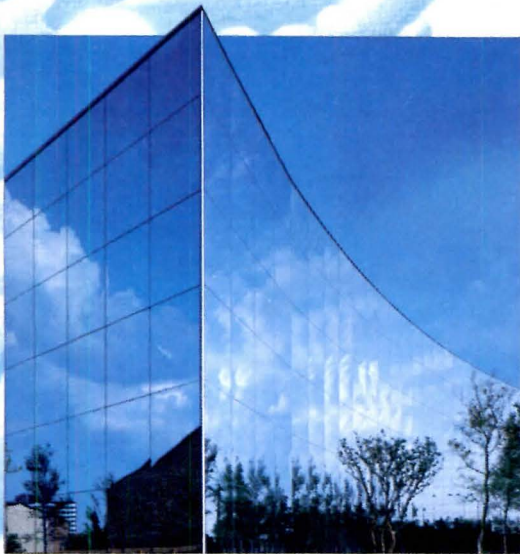
consequences of such bulk? The Burgee/Johnson buildings rise straight from the street line to their six-to-nine-story sloped "mansard" roofs. The tallest of them even dwarfs the adjacent former Knickerbocker Hotel, a substantial Second Empire pile that provided the stylistic inspiration for the Burgee/Johnson scheme.

If the UDC accepts the Park Tower proposal, it will mean throwing out the complex and highly specific bulk and appearance guidelines developed by Cooper, Eckstut. (If followed to the letter, the guidelines virtually design the buildings.) These mandated taller structures with many small-scale setbacks intended to get more light down to the street level. Much larger, and by Park Tower's reckoning, more rentable office floors are allowed by the lower bulk of Johnson's buildings. The UDC claims the Park Tower scheme tested out better than the CEA recommendations. This may be true, but only because the Park Tower scheme requires the demolition of the former Times Tower. The Cooper, Eckstut guidelines never proposed demolishing the tower, as the ball that falls from the top of the building every New Year's Eve was felt to be sacred. The square footage sheltered by the Times Tower, however, has been included in the new buildings, and the total proposal still exceeds CEA's guidelines by nearly 100,000 square feet.

Is the plan for the Square better without the Times Tower? Is the UDC prepared to condemn it? The UDC's final intentions are not known at present: they are "considering" this aspect of the Park Tower scheme. Did CEA (with the advice of Eastdil Realty) truly propose unmarketable buildings? Or was Park Tower's financial package more appealing than other proposals that followed the guidelines more closely? We don't know, because the alternatives were not publicly released or discussed in the UDC's environmental impact statement.

Marketability, of course, *is* crucial to the plan. Substantial Federal and state help is no longer available for large-scale urban renewal schemes, so the City has agreed to relax zoning mandates in return for a contribution from the office tower developer of $21.6 million to rebuild the 42nd Street subway concourse and $9.5 million for theater renovations. The selected developer, therefore, has tremendous leverage with the City and the UDC since the most appealing elements of the scheme— the theater restorations and subway improvements—are linked to the successful conclusion of an

agreement on the office towers. The future "cost" will be borne by a permanent encroachment of light, more crowding on sidewalks, and congestion in the streets.

The City and the UDC have tried to downplay the extraordinary proposed density, but there is simply no escaping the conclusion that the density required to generate the cash flow for renovation of the subway and theaters has seriously distorted the urban design intentions. Can good architecture be made of this? Thirty- to 40-story street walls and a 300-foot tunnel along 41st Street speak for themselves.

The theaters: preservation, but at what cost?
The renovation of theaters is being used as justification for the enormous density of the office towers and the incompatible use represented by the mart. Unfortunately, however, successful renovation of the midblock theaters is by no means assured. In almost three years of trying, UDC has not been able to secure a firm proposal for Site Five, which contains five of 42nd Street's 10 legitimate-type theaters. Of these, UDC has proposed as an alternative to complete restoration the conversion of the Times Square Theater into a common lobby for the other four (the Lyric, Selwyn, Apollo, and Victory). Elsewhere on the street, three theaters—the Rialto, Harem, and Anco—are not mentioned in the UDC guidelines and would be razed. At this time only the New Amsterdam, probably the most important Art Nouveau interior extant in the United States, and currently being restored independent of the development project, is certain to be returned to legitimate theater use. The preservation of the theaters along 42nd Street is being touted as "making up" for the destruction of the Bijou, Morosco, and Helen Hayes theaters for the Marriott Hotel project under construction three blocks north on Broadway. But the gain may be ephemeral: of the 12 theaters in the over-all project, only five would be returned to legitimate theater use under the most propitious circumstances, and two of these have been or can be renovated even if the development project fails.

Somehow, the sense of what is unique about Times Square has been lost. The stables and carriage houses that used to surround the Square moved away because Times Square became not just New York's but America's premier entertainment district. It had theaters—some 80 of them—lavish music halls, and luxurious hotels. The subway and *The New York*
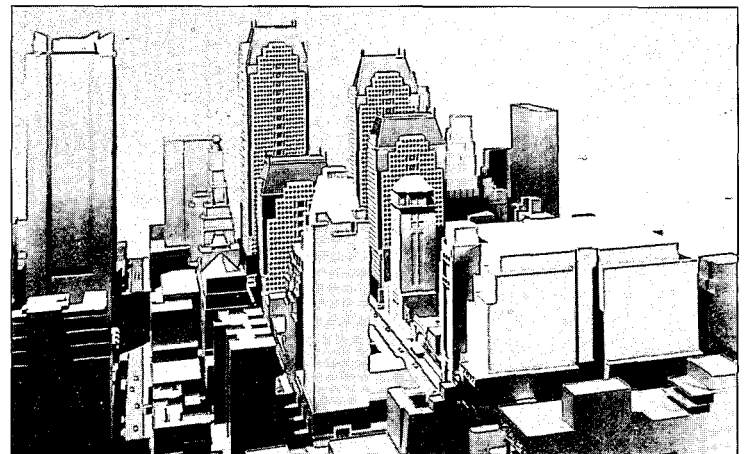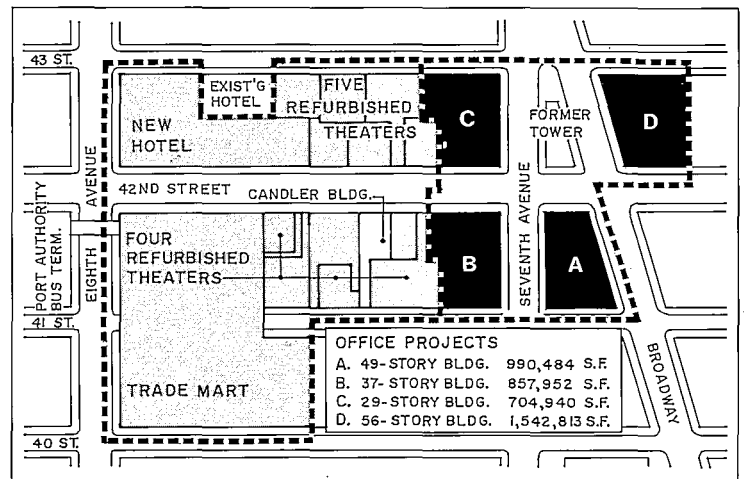
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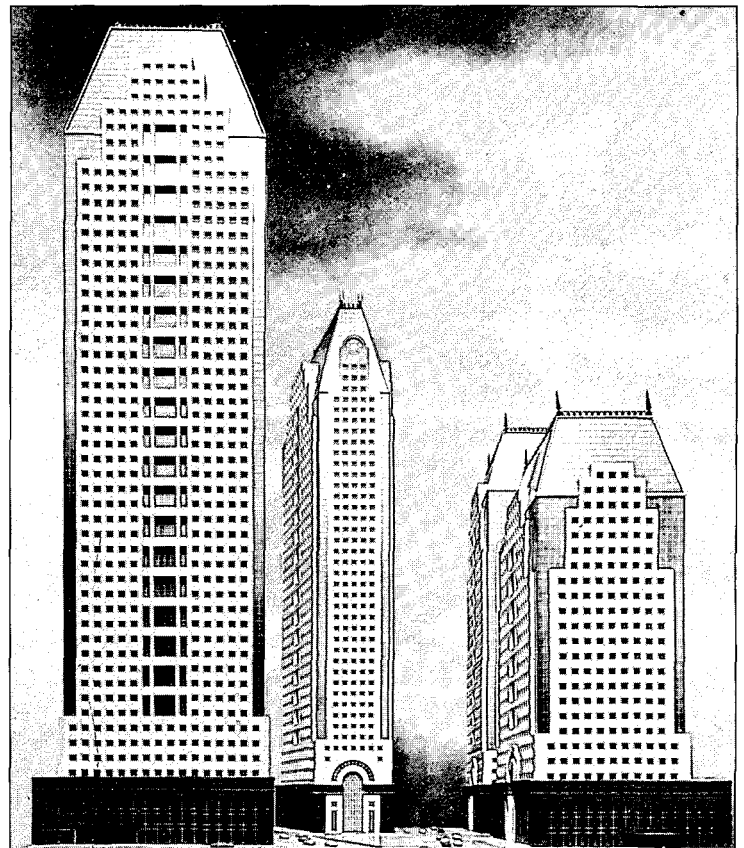
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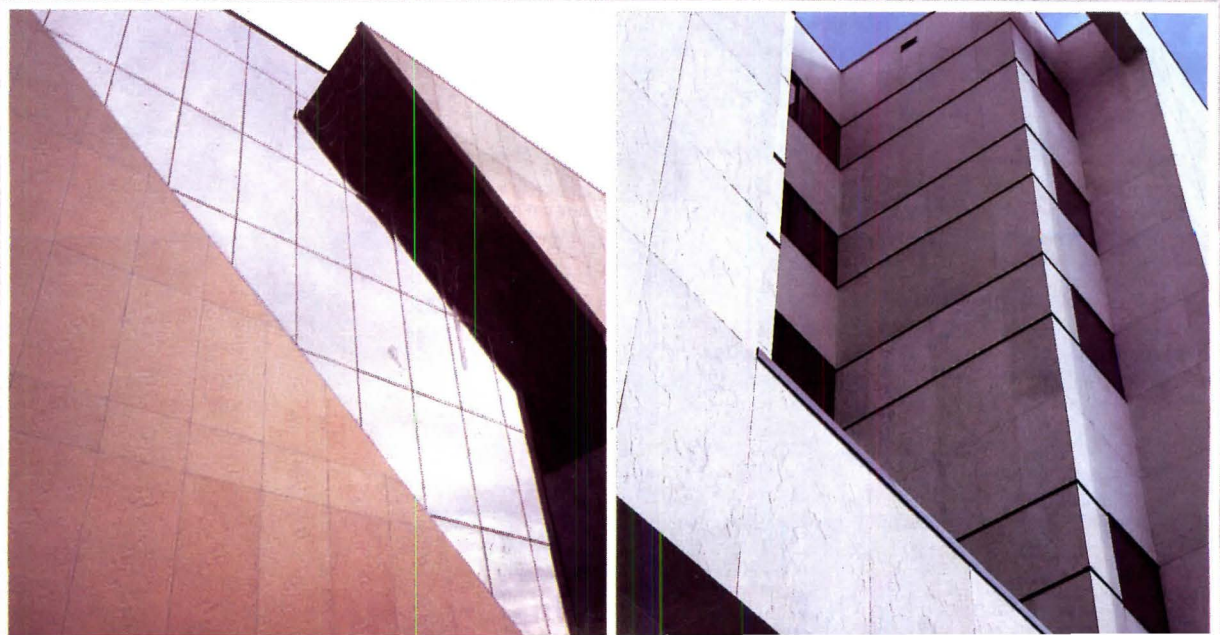
Times came in 1904 and helped to transform the intersection of Broadway and 42nd Street into the "Crossroads of the World." Although the Square more or less prospered for the following 50 years, the story of the post-World War II decline of the area is well known. The legitimate theaters on the side streets have held on and, to some extent, flourished. But on the Square itself the Palace is the only stage theater currently in use; the rest of the area attracts crowds to video arcades and first-run teen and action movies.

Still, it should be noted that even the "heyday" of Times Square was always ephemeral, with some elements constantly in decline and others in the ascendancy. There have always been many more flops than hits on Broadway, and the history of the Square shows that this relationship was not true just of the stage. The Square has continuously evolved, but the formula that has allowed what vitality remains combines things big and small: the movie palaces and the grind houses, Sardi's and the small delis. Even though Times Square attracts thieves, drunks, bums, hookers, and pushers, the movie-goers, the theater crowds, the signs, and the traffic still spark that famous energy. Oddly, that energy will be sapped, not strengthened, by the new development. Entertainment uses are not encouraged on Times Square as part of the 42nd Street Redevelopment Project. Once lobbies, subway access, and service entrances are fitted into the office towers, there is no room for legitimate theaters or even movie houses. Office-related retail space is the proposed street floor use, suggesting a ghost town ambiance after 5:00 p. m. similar to that encountered on Avenue of the Americas a block east.

A similar attitude is seen in the office towers themselves. Cooper, Eckstut's guidelines envision a picturesque assemblage of towers reminiscent of Rockefeller Center and a retail environment evocative of upper Madison Avenue. Burgee/Johnson seem to be trying to capture the feeling of turn-of-the-century New York: the Plaza Hotel blown up to three times its already inflated (from its Chateau forbears) size. The Square is bursting with its own style and vitality. Why do the architects have to look elsewhere for inspiration?

In a "special features supplement" to their guidelines, Cooper, Eckstut did require the office tower developer to provide an elaborate system of building lighting and a band of super-scale signage as an attempt to recreate at least a veneer of Times Square's

traditional bright lights. These requirements were ignored in the Burgee/Johnson design: who, after all, would put electric signs over the windows of office space renting at $40 a square foot? (The nervousness of developer Park Tower Realty is betrayed by reports that they have asked Burgee/Johnson to revise their scheme and by their retaining Venturi, Rauch and Scott Brown, whose giant Magritte-like apple for the site of the Times Tower is supposed to liven up Burgee/Johnson's button-down architecture.)

There seems never to have been a recognition that forms of entertainment other than theater are also "legitimate." The guidelines do not encourage movie theaters or nightclubs, rehearsal space, or stages for dance and music (except Broadway musicals). These uses frequently cannot generate the revenues per square foot that office or retail space can. They are, however, indispensable elements of what makes New York a center for the arts. A scheme that sought to revitalize Times Square and the Theater District for arts and entertainment might look at ways of encouraging uses compatible with theater. The environmental impact statement prepared by the UDC recognizes that commercial occupancies and rehearsal space related to theater may be pushed out by the new development, but it offers no mitigating measures. The giantism of the plan, then, is at odds with the idea of a coherent theater or entertainment district. Without Times Square as the linchpin, there will be no recognizable district, just a bunch of theaters scattered along various side streets.

The need for coordination
The 42nd Street Redevelopment Project is not the only large-scale building proposed for the Times Square area. Three blocks north the Marriott Hotel is nearing completion; still further north development is moving west from Avenue of the Americas to Seventh Avenue and Broadway (new headquarters for Equitable Life, designed by Edward Larrabee Barnes, and a new hotel by the Gruzen Partnership are already under construction), spurred by newly enacted zoning that allows midtown-type density in this area for the first time. With the Marriott and 42nd Street projects to tie down the southern flank, the northern end of Times Square—the heart of the theater district—is the next obvious direction for what could become a speculative tidal wave. Somehow the City has never pulled these actions together into a coordinated strategy, and it is only

now scrambling to find a way to deal with the clearly endangered legitimate theaters. The Theater Advisory Council has recommended that developers be allowed to purchase air rights from the threatened theaters for use elsewhere in the district. The recommendation is controversial and will further aggravate dichotomies of scale by encouraging the aggregation of purchased square footage and allowable square footage to create enormous buildings rising out of a relatively low-scale context.

Incentives to save existing theaters and build new ones do exist in the zoning but in a midtown-style speculative frenzy, incentives may not be enough as the underlying land becomes too valuable. Indicative of what the future may hold is the Portman-designed Marriott Hotel development on the Square. This "revitalization" required the demolition of the Morosco, Helen Hayes, and Bijou—all functioning, landmark-quality theaters. The battle over the skyscraper proposed for the last substantially undeveloped site on Park Avenue—St. Bartholomew's community house—shows that when the location is right, not even landmark churches are "sacred."

The future of Times Square
Without a coordinated strategy Times Squre will travel one of two divergent paths. If the 42nd Street plan fails, those who feel there is a future in Times Square will see their hopes dashed yet again, and the area will continue to deteriorate. On the other hand, if the plan succeeds, the momentum will have been created for the (Avenue of the) Americanization of the theater district, and the future of the area will be large-scale office building development. Most of the movie theaters on the avenues will disappear, and a number of legitimate theaters will unquestionably be threatened by new development.

Since the city really has no plan to deal with the "street people"—the alcoholics, drifters, prostitutes, sidewalk drug sellers—aside from driving them out ("scattering them... and then we hunt them out," said William J. Stern, chairman of the UDC, in a *New York Times* article), the result may be that nearby parts of the Times Square area become less safe and more blighted, further threatening the healthy existing businesses. This situation in return requires more large-scale, government-sponsored development to disperse the undesirable element further.

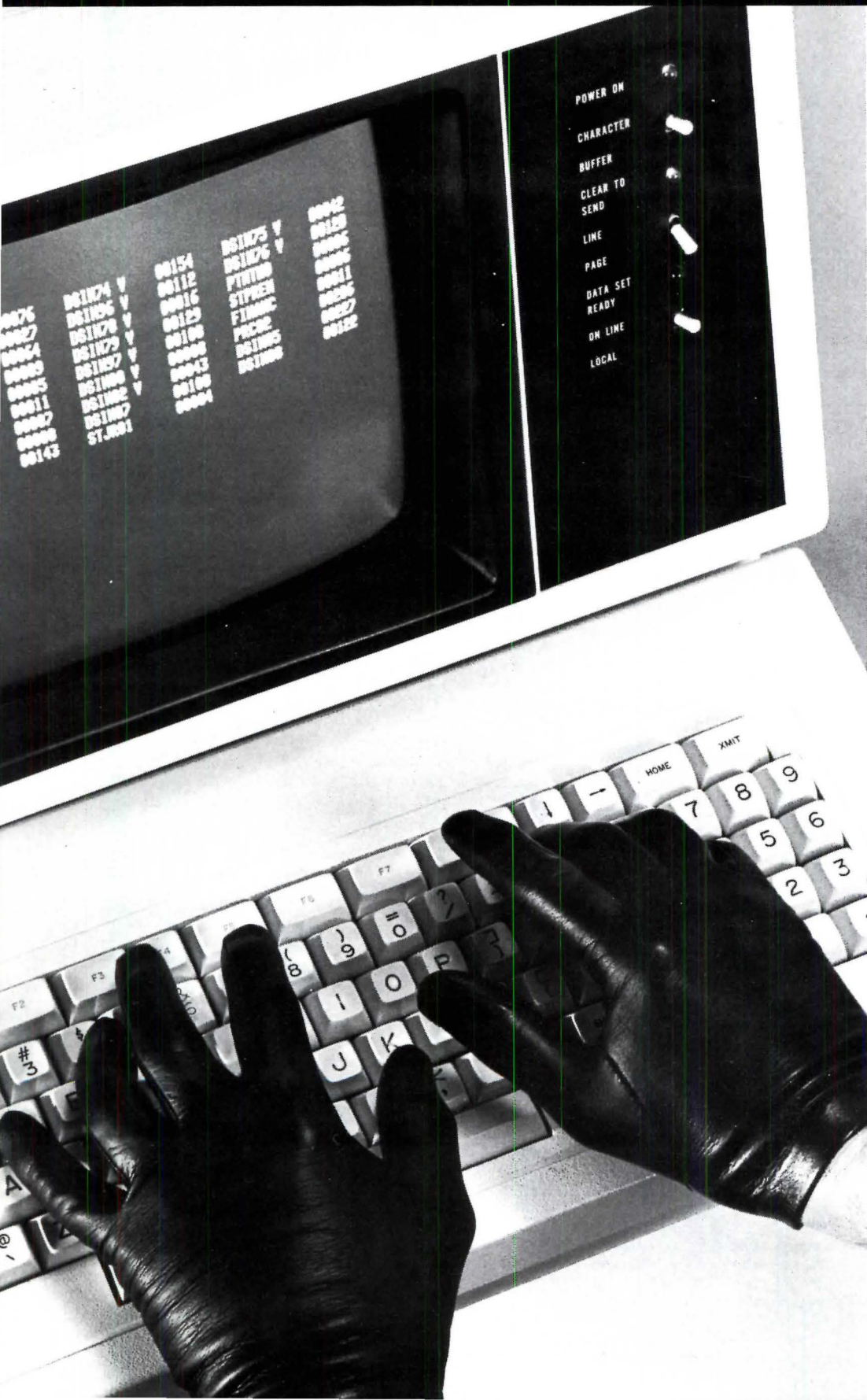Clearly, many of the problems of the Times Square scheme are unique—the extraordinary

concentration of theaters, for example, simply does not exist anywhere else—but many of its troubling aspects are indicative of stumbling blocks in a new kind of urban renewal. Are the private developers furthering the city's urban renewal aims or just profiting from a kind of super-gentrification? Is the city abrogating its obligation to its citizens when it relaxes zoning regulations, or is it simply responding to the fiscal reality of "supply-side" urban renewal? These are the questions that must be asked throughout the development of the project, as it may become a model for urban redevelopment elsewhere in the country.

The UDC feels that if its goals of renovating theaters, eliminating blight, and restoring the subway concourse are met, the project can be considered a success. But is the project a success if the cost is the energy and unique qualities of Times Square? The inability of both architects and urban designers to include gracefully the incompatible but moneymaking elements into the scheme demonstrates yet again that, despite promises of politicians and experts, there is no such thing as a free lunch.

Just as this article was about to go to press, a final 1,100-page environmental impact statement was released by the UDC. Although the report did single out several negative aspects of the over-all Times Square redevelopment scheme—namely, increased rush-hour crowding on subways and buses, deep shadows resulting from the tall office buildings, and growing economic pressures on the adjoining Clinton neighborhood—the report listed ways to mitigate these factors. The impact statement also recommended that the former Times Tower "be substantially modified or replaced." In other recent developments the UDC announced that Cambridge Investment Group, Ltd. has been conditionally designated to convert the Lyric and Selwyn theaters to legitimate use and to purchase the already-renovated Apollo. The Times Square and Empire theaters will be converted to retail/restaurant use. The Nederlander Organization has been conditionally named to convert the Harris to legitimate use.—Ed.

Adding on, fitting in

In the new campus climate of competition for a dwindling pool of potential students, with schools short of the peak of the academic pyramid advertising and the best-qualified students shopping, colleges are moving from a period of unquestioning expansion to one of consolidation and a perhaps belated concern for the quality—real and perceived—of student life. Often, this concern takes the form of added physical amenities: more and more livable housing, a student union, new recreational facilities. But it is also being expressed in the recognition that quality of life encompasses not only activities but ambience as well: the serenely beautiful campus world that colleges portray on the covers of recruiting brochures—ivy-decked Old Main cresting a green-swathed rise resplendent with flaming foliage kindled by a brilliant autumn sun. (Somehow, save on their opening, recent buildings are seldom depicted.)

Like towns and cities, colleges are coming to know that the once prevailing attitude of "if it's old, tear it down" is itself an outworn (as well as wasteful) conceit. The issue, however, is not new versus old, but new growth springing from old roots. The budding may be literal: witness the increasing tendency to provide needed space incrementally, by adding to existing buildings. Or it may take the form of a graft: a new entity that enriches the established campus organism while drawing on its strength. In either case, the theme is continuity and harmony between old and new, and the goal an integrity of place that delights both eye and spirit.

With this view abroad among colleges, it is perhaps not surprising that the architects chosen for the campus projects shown here share a deep and informed attachment for the milieus in which they worked. The student housing complex Hugh Newell Jacobsen designed for Georgetown University lies in the heart of the neighborhood where he has lived and practiced for many years. Lo-Yi Chan of Prentice & Chan, Ohlhausen, whose addition to an elderly Dartmouth classroom building transforms it to an interdisciplinary academic center, grew up in Hanover, completed his undergraduate studies at Dartmouth, and is now engaged in the college's master planning. As a young architect, Cabell Childress, author of the new dance building at the University of Colorado, participated in the university's 1960s wave of campus expansion and took the occasion to probe its every cranny: It is still, he asserts, the most beautiful of some 65 campuses he has explored.

Nor is it surprising that each of the architects characterizes his as a "background building" that strives not only to achieve compatibility with older structures but to partake of their essence and quietly reinterpret their form and detail. To Chan this meant "valuing the status quo while changing it." To Childress, "honoring without imitating." And Jacobsen sums up: "Architects no longer have to make a 'bold, original statement' every time out." *Margaret Gaskie*

Good neighbor policy

Village B Student Housing
Georgetown University
Washington, D. C.
Hugh Newell Jacobsen, Architect

On white nights, says architect Hugh Jacobsen, he doesn't count sheep. "I stroll the streets of Georgetown and count the buildings I've worked on—a kitchen here, a bathroom there... I hardly ever get all the way to 90." Jacobsen has also done his share of day-walking on Georgetown's streets in the years he has lived and worked in this chic but cozy village within the city of Washington, D. C., absorbing the quaint charm of its vintage buildings with the astuteness of the trained observer as well as the fond casualness of the frequent passerby.

So it was as a knowledgeable and neighborhood-proud village dweller that he approached his first major commission in Georgetown, the 360-student "Village B" housing complex for Georgetown University. Because the site, a full half-block between N and O streets at 37th Street, was inescapably prominent, Jacobsen's first concern was to avoid obtrusive institutionality by suiting the project in scale and spirit to the mostly small residences on the streets surrounding it. And what better image to project in a neighborhood of richly and variously detailed town houses than that of the town house?

The unwonted (and unwanted) mass of the complex accordingly is broken into three major elements (site plan page 151), a block-long structure on 37th Street and smaller buildings on the intersecting streets, arranged in a U-shape around a spacious park that is a private preserve for residents of the complex—and a preserver of privacy for residents of homes nearby. The blocks in turn are divided into house-size units that not only conform to the prevailing streetscape but also recall the "stair-entry" plan of early dormitories and answer the university's request that units be readily convertible to private housing.

The expression of the large dormitories as small town houses was abetted by a steeply sloping site that drops 22 feet along the street from north to south, lending itself naturally to a broken roofline whose steps define individual units. By inserting English basements, Jacobsen was also able to provide four living floors within an apparent building height of only three stories. The same trick was played with a shallower slope at the north end of the site, where three-story units seemingly diminish to the two-story height of the house immediately adjacent.

The three-story-plus-basement dormitory on the south does not defer in height to the two-story row houses next door, but instead presents itself as a larger, similarly proportioned version of the block. The row houses exemplify the low-scale Italianate style that burst on Georgetown just before the Civil War and continued in vogue well into the 1880s, and it was this motif (with Federal undertones) that Jacobsen adapted to kindle the dormitories' otherwise plain-Jane brick facades.

Properly slender parlor-floor windows shorten as they rise to an over-scale cornice fashioned (at considerable savings over wood) from vacuum-formed fiberglass in a creamy ivory that repeats the window trim. In true Georgetown fashion, welcoming stoops approach entrance doors that, though glazed for security, boast slim-paned frames painted alternately in hunter green, burgundy, and navy to lend the houses a touch of identity. Stair railings of charcoal-green wrought iron link with areaway fences in a typically Washingtonian pattern traced from an original rescued from a junkyard. Lintels over doors and windows, precast in concrete rosy-dyed to mimic sandstone, are embellished respectively with entwined GUs and bullseyes. (Not even the copper scupper boxes are neglected, but embossed with discreet GUs.)

For all his painstaking pleasure in facade detail, however, Jacobsen forgoes restraint only at the buildings' ends, which erupt in an Italianate fantasy of ornate oriels (pages 152-153) that yet serve the practical purpose of bringing light and elbow room to enclosed stairs. Nor are the lacy pendants simply playful adaptations but addenda to Jacobsen's ongoing "exercises in abstraction": as in much of his work it is the knowing manipulation of scale that gives the game away.

Jacobsen's intent was *to endow his* hometown with a soft-spoken "background building" that would complement its more picturesque predecessors. He has done much more—and done the neighbors proud.

The U-shaped dormitory complex encloses a broad swath of tree-dotted lawn that serves as a private outdoor commons intended to foster a sense of community among the residents of the individual town houses. Graded level, the park adjusts to the steep slope of the site with a tightly planted berm that falls abruptly to a terrace behind the south dormitory building. (Pedestrians negotiate the drop via a demi-monumental brick stair.) Behind the enfillades of newly planted trees that rim the green, the courtyard facades of the town house dorms replicate the faces they turn to the street. But the shift from townscape to the "country" scene implied by the commons renders the buildings curiously ambiguous in scale, requiring for a correct reading the presence of people—or perhaps a bicycle casually propped against a typical Washington lamppost.
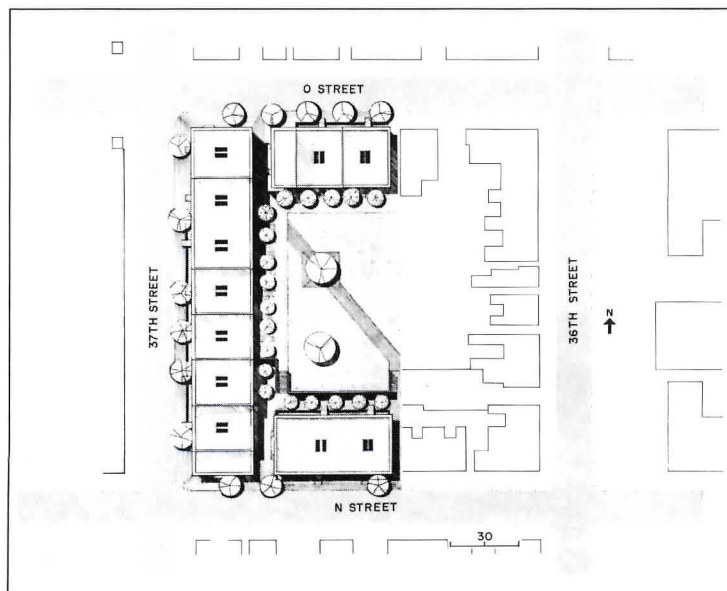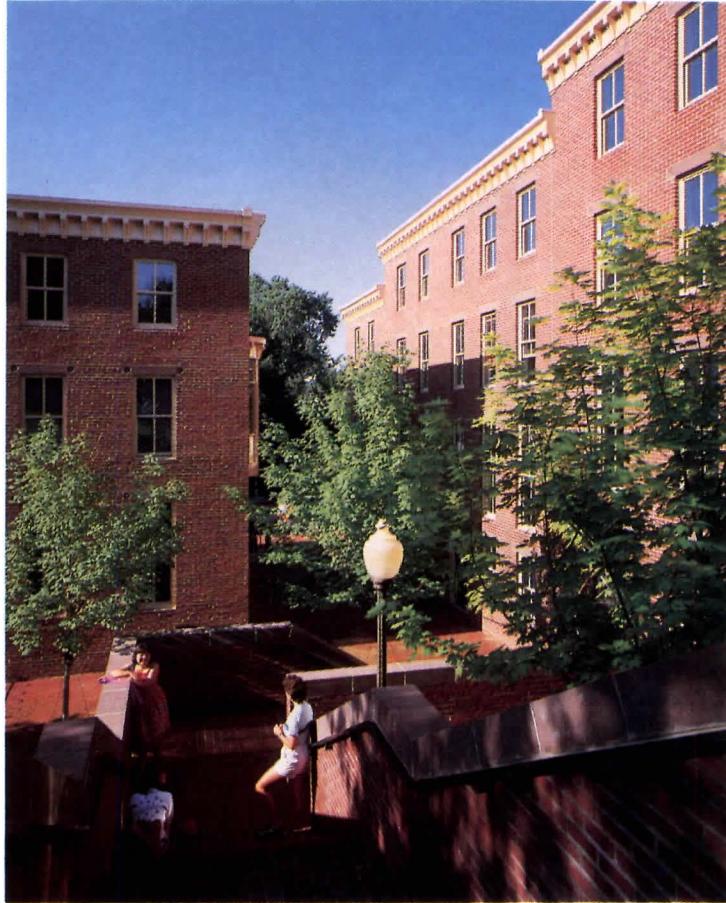
The town house units at the end of each dormitory block are embellished with airy oriels (photos below and opposite) that bring light—and delight—to enclosed entry stairs. Because the university wanted to hedge its bet by making the town houses readily convertible to private apartments should they no longer be needed to house students, the living spaces within offer a degree of privacy and amenity unusual for college housing. The two four-student apartments on each floor of the units are floor-through flats (typical plan at bottom) that comprise two small bedrooms with built-in bunks and desks, a well-equipped kitchen, and generous living-dining-study space. Interiors and furnishings, designed by Jacobsen, feature upholstered pieces in the school colors of gray and blue, and king-size study-dining tables.
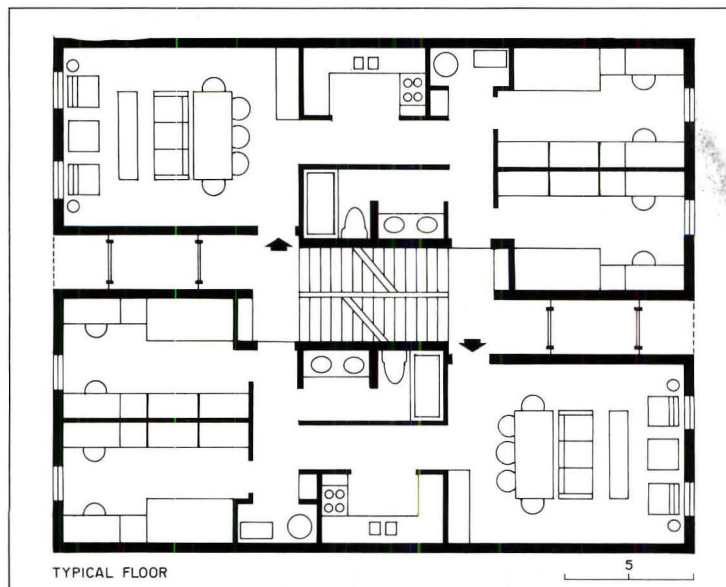
TYPICAL FLOOR

5

Dance Building
University of Colorado
Boulder, Colorado
Cabell Childress Architects

Feeling the spirit

Departing from the invariable symmetry of Klauder's work, Childress set the building entrance near the juncture with the earlier addition, which is marked by a narrow window from roof to base. The base of the new building drops to a walled sunken court, a favored Klauder device for reducing scale. Set almost flush against the smooth tight-mortared brick facade, limestone trim surrounds the arched windows and cartouche-capped entry porch, then continues in a trim belt course that ties into the portal linking the building with its near neighbor. At the cornice, corbeled banding repeats in plain the ornate friezes of the older buildings. Only half of the massive portico's 20-by 14-foot opening was needed for the actual entrance—so that is what Childress used, urging the point with a half-fanlight.

That the University of Colorado has largely evaded the "look at me" excesses of latter-day collegiate expansion reflects the mixed blessing of Colorado's home-grown architectural conservatism and its jealous guardianship of its premier institution: When in the mid-'60s the university announced a long-studied, long-range development plan, the state senate, vigilant against reckless avant-gardism (and prodded by the local press), promptly passed a resolution "to condemn any change in the present Italian Renaissance style [sic] on the Boulder campus."

This "if it ain't broke don't fix it" conservatism, happily, has been ameliorated by administrative stewards who have, on the whole, followed the better-lit path of conservatorship, accepting—even welcoming—change but insisting that it be evolutionary rather than revolutionary. The school has, since 1919, built from guidelines then set by architect Charles Z. Klauder of the Philadelphia firm Day & Klauder, who established a design structure so strong it has held through occasional times of drift and today remains the campus core.

Klauder's legacy to the University of Colorado is a picturebook enclave nestled high on a mesa hard against the abruptly rising foothills of the Rockies. Red-tile roofs—hips and gables and "book-end" half-gables crowned by dove-cote chimneys and here and there a tower—rest on robust walls laid up with thick slabs of sheared native sandstone in an earthy spectrum from pale gold almost to purple. Cut-stone details elaborate the focal points of imaginatively massed but always symmetrical buildings abounding in arcades and loggias.

Klauder's freely adapted "Architecture of Rural Italy" was realized in only 13 projects completed before his death, but nonetheless left a stylistic imprint that still embodies the spirit of the university. So too his master plan, although it encompassed but a corner of today's sprawling campus and key parts of the scheme were never built.

Confronted with a scraggly collection of freestanding buildings in a grab-bag of styles, Klauder made them the genesis of a focal mall to be framed by continuous buildings and intersected by a cross axis. On the periphery, buildings were closely set around alcove-like courts to create the casual network of intimate sub-spaces that now lends the old campus the piquancy of contrasting enclosures and changing vistas.

It was in the yet-unfinished Old Mall, the campus "historic district" (the major buildings there in 1919 are still there), that architect Cabell Childress was asked to place a new building to house the university's dance department. A challenge to any architect sensitive to context, the dance building is an addition to an inexplicably Prairie Style 1928 addition to a vaguely Romanesque 1902 library, now a theater. The Guggenheim building adjoining the site is vaguely Classical. Across the mall sits the original (c. 1876) college building, Old Main, a red-brick pile of Victorian jiggery-pokery. The imposing Collegiate Gothic of Macky Auditorium (c.1907) marks the nearby cross axis, while the mall closes with Klauder's splendid 1940 library.

For Childress, an unabashed admirer of Klauder's work, the task of blending the dance building into this contextual medley was enhanced by his hope of bringing to the uncompleted mall something of the original vision, "honoring Klauder without imitation." The contiguity of the building with the theater complex contributed to the missing closure, but Childress went farther, also linking the adjacent building via a vintage Klauder portal. In addition, though the four-square plan discouraged articulation, he wrapped the rear corner of the building in a shallow two-story ell that defines a secondary courtyard.

Resisting split sandstone, Childress turned instead to the gray-gold brick of the immediate neighbors, facing the mall with a reticent slab animated only by a Klauderian sunken base court, subtle masonry detail, and an off-center trio of arches—a portico overscaled to match the old library's grand entry and smaller stone-inlaid arches that paraphrase its windows. At the roofline the dance building is tied to its predecessors by a mediating cornice, while Klauder is echoed in its red tiled roof and the increasing vivacity of its off-mall facades.

Haidar photos
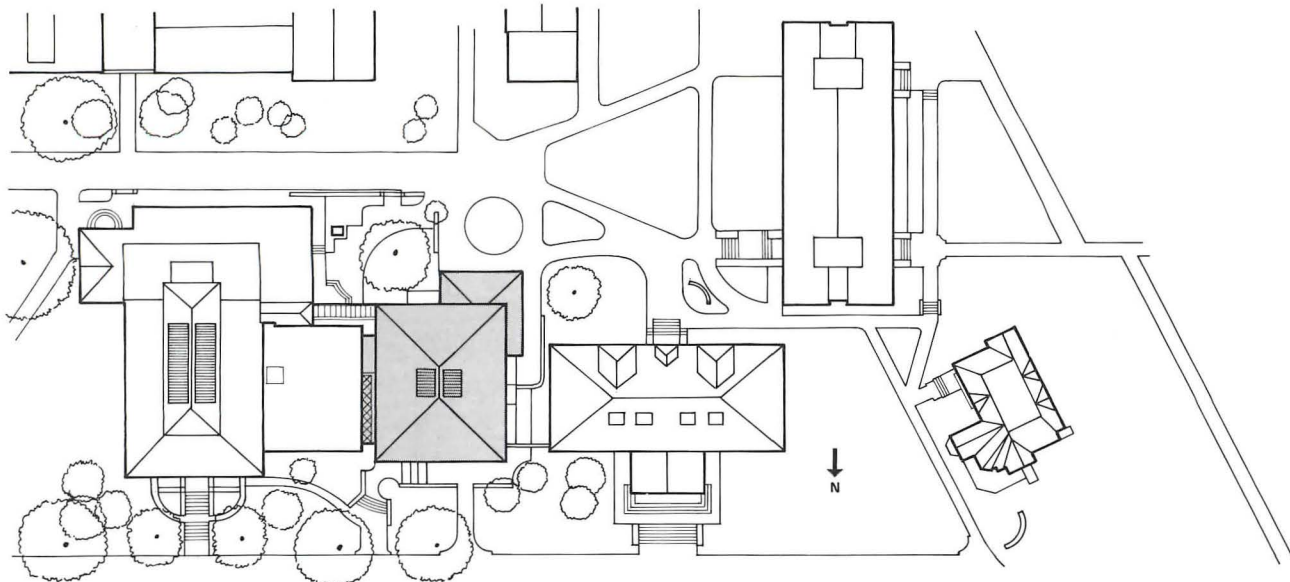
As the dance building rounds the corner through the linking portal (bottom photo) its sober mien is livened by a strip of limestone-trimmed vertical windows that interrupt the corbeled frieze, a more emphatic strip above the belt course, and a tall arched window on the face of the ell. Finally, at the rear facade, where the motley of the Old Mall gives way to a court ringed by neo-Tuscan buildings, Childress's fondness for the style breaks through—though still tightly reined. In addition to the articulated ell and the layered roofs, the facade sports under-the-eaves windows and two entries. One replays (as does the portal on the quad) a recurring Klauder detail: top-heavy limestone arches overlapping slim surrounds. The crowning touch is a skylight topped by the tile-gabled cap of a mock "dove-cote chimney."

Dance Building
University of Colorado
Denver, Colorado
Owner:
University of Colorado
Architects:
Cabell Childress Architects—Cabell Childress, principal-in-charge; Ida Vorum, project architect; Jane Marshall Smith, David Solomon, Anna Rodewald, project team
Engineers:
Anderson and Hastings (structural); McFall, Konkel and Kimball (mechanical); Garland D. Cox and Associates (electrical); David L. Adams Associates (acoustics); Chen and Associates (soils)
General contractor:
Roberts Construction Company
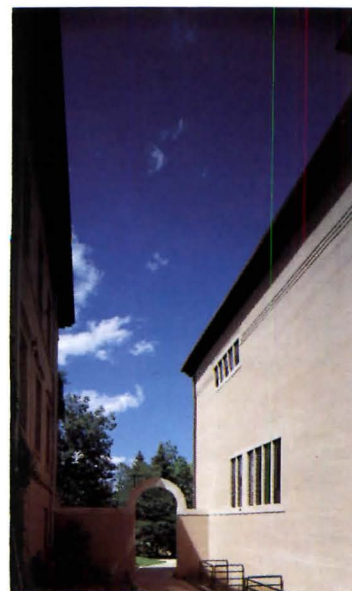
Although the program (and budget) made no allowance for such a space, Childress was able to insert a small but lively lobby between the dance building and the adjoining structure, connecting the upper floors of each with balcony bridges and leaving the mellow gray-gold brick face of the 1928 building exposed (right in photo below). Bisecting the lobby are elaborated columns on chunky, bright-painted pedestals that support a balcony surmounted by a sweeping arch. In one of the tiny space's most charming surprises, the wall of the new building meets the ceiling in a half-vault that suddenly (and impossibly) reverses itself over the entrance to follow the curve of the fanlight. The principal ground-floor space, a vast studio in constant use for teaching and practice, can also be used to seat an audience of 150 for performances, leaving the dancers a theater-size 45- by 45-foot "stage." The studio is rigged for theater lighting and drops, and is overlooked by an observation mezzanine and control booth. The third floor houses a large ballet studio lit by a skylight and high strip windows (photo below), and smaller studios for advanced classes. The floor below grade is given over to costume shops and utilities.

MAIN FLOOR

UPPER FLOOR
20

The Nelson A. Rockefeller Center
for the Social Sciences
Dartmouth College
Hanover, New Hampshire
Prentice & Chan, Ohlhausen,
Architects
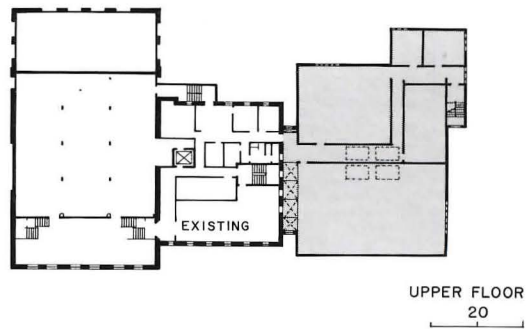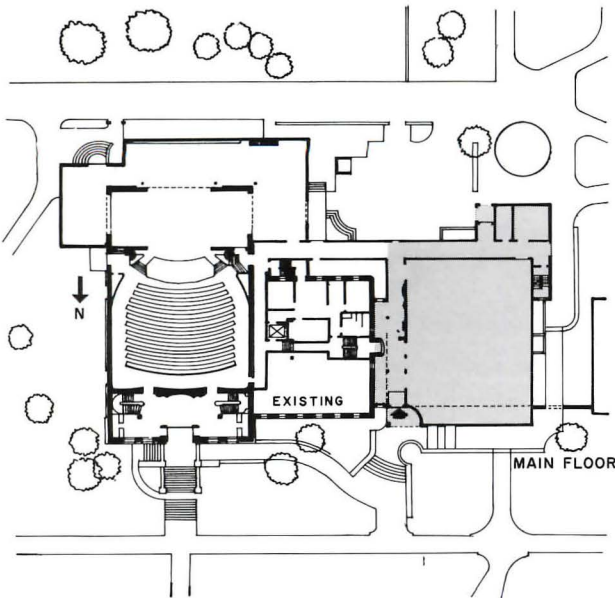
Both-and, not either-or
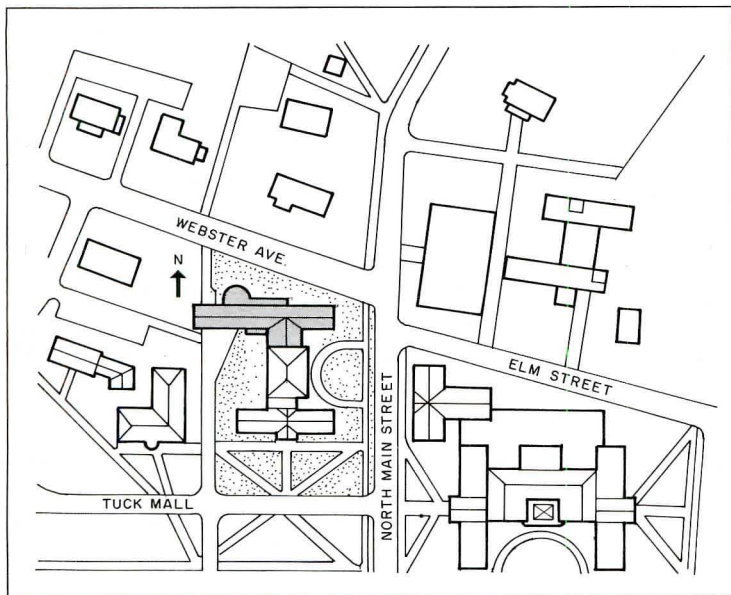
"For almost 50 years," says architect Lo-Yi Chan, "Silsby Hall sat facing North Main Street like an armchair with one missing arm," despite clear evidence of its architect's intention of completing the building as a symmetrical H-shaped form fronting on the street. So when Prentice & Chan, Olhausen were commissioned to develop the Nelson A. Rockefeller Social Sciences Center by integrating new classrooms, faculty offices, and gathering places with the existing facilities in Silsby Hall, adding and extending the 1927 neo-Georgian building's missing wing seemed a self-evident solution. Meanwhile, Chan's researches into the campus archives had unearthed a 1922 John Russell Pope campus plan that proposed two pedestrian malls running parallel to the Dartmouth Green. Both had since become choked by cars and parking, but the expansion of Silsby Hall held promise of steering the west mall, which traces a beeline from a cluster of dormitories and fraternity houses to the dining commons, back toward pedestrian use.

The massing of the Rockefeller addition thus devolved to a new north wing whose east end "completes" Silsby and whose west end stretches to encompass a courtyard and formal portico that introduce the restored mall. The question of style, however, was more problematic. "Any new structure at Dartmouth" Chan believes, "should be part of a much larger fabric woven over 200 years. I wanted to be part of the past, yet point to the future. This 'both-and' approach," he adds, "is a major shift from the 'either-or' of modern architecture." Indeed it is. And it was only after much soul-searching that the firm decided the east end of the addition to Silsby Hall should not merely be compatible with the red-brick neo-Georgian of the original building but should replicate it—brick for brick, false chimney for false chimney (photo left). (The only changes are "improvements": slightly narrower—and so more authentic—double-hung windows, a proper ground-hugging base precluded in the original by the need for cellar windows, a lighter brick to age to a matching patina.)

"As little as five years ago," Chan confesses, "we wouldn't even have thought of replication." Nor, it seems probable, would the designers have tolerated the ambiguities that mark the north facade as it moves from Georgian to contemporary—and back again. Although the basic shape of Rockefeller Hall follows the low, rectangular, base-shaft-roof configuration common to Dartmouth's older buildings, variations were dictated by the stretched-out profile resulting from the addition of a ceremonial portico at the mall (and the consequent location of the main building entry within its embrace) and by a program that called for placement of major gathering and teaching spaces on the lower floors, with smaller offices, lounges, and seminar rooms on the upper floors.

To accommodate the programmed spatial requirements within the traditional three-story building height, the principal classrooms—large-group lecture halls and a teaching auditorium—were placed below grade and the administrative area above was pulled out from the building face to form a low ground-level extension. Accented by a negative-pedimented secondary entrance on the east and the curved wall of an inner lounge on the west, the extension moderates the over-long building profile and softens the awkward relationship between Rockefeller Hall and the angled street it fronts on. It also mediates, while emphasizing, the shift from a load-bearing structure at the building's ends to the post-and-beam of its central portion.

Because a primary goal of the center was to physically concentrate, and so encourage cross-fertilization among, the academic disciplines within its purview, the heart of the plan is the Forum, a skylit vertical atrium that turns a tight corner connecting Rockefeller to Silsby Hall, forming a major study, lounge, and assembly area. Host to an astonishing number and variety of programs in its first year, the Forum mirrors in its success that of the complex as a whole. "It is a literally attractive building," says Center director Frank Smallwood. "People who are first drawn by its vitality also find it comfortably familiar—as if it had always been here."

The varied fenestration of the north facade of Rockefeller Hall (below) reflects and reinforces the modulation from neo-Georgian at the building ends to contemporary at the center. In traditional fashion the windows throughout diminish in size as they rise from base to upper stories, but in the central portion of the facade they also evidence the transition from the only partially defined bay structure on the top floor to the full ribbon glazing of the second floor and the clear post-and-lintel framing of the extended ground floor, where window strips are punctuated by engaged brick columns. The return to load-bearing construction at the portal is signaled by a massive brick wall complete with mock quoins. Here, top-floor windows are again a free adaptation from the Georgian—but expressed horizontally.

©Peter Vanderwarker photos

The west end of the grand portico
introducing the social sciences
center courtyard and the embryonic
pedestrian mall beyond borrows its
trio of double-hung twelve-over-
twelves and the Palladian attic light
directly from the front facade of old
Silsby hall (and the identical new
ell), the arches from nearby dorms.
Turning the corners, however, it
adopts the new architectural order,
becoming a bluntly squared-off

gateway crowned by vaguely Oriental snow-catchers embellished with metal scrolls that culminate in twinned R's (for Rockefeller, what else?). Under the portal the bow that softens the north facade reemerges in the entry porch and stairs (which extend to form benches in the courtyard) and continues in a double curve along the south face of the wing. The glazing of this curved window wall repeats the small-paned windows of Silsby and, like the other side of the widened building base, is colonnaded with almost-freestanding brick-faced columns capped by an "entablature" with architrave, frieze, and cornice suggested by raised brick bands and vertically laid courses. Similar masonry details accent the lintels of upper windows and the portal.

MAIN FLOOR

EXISTING
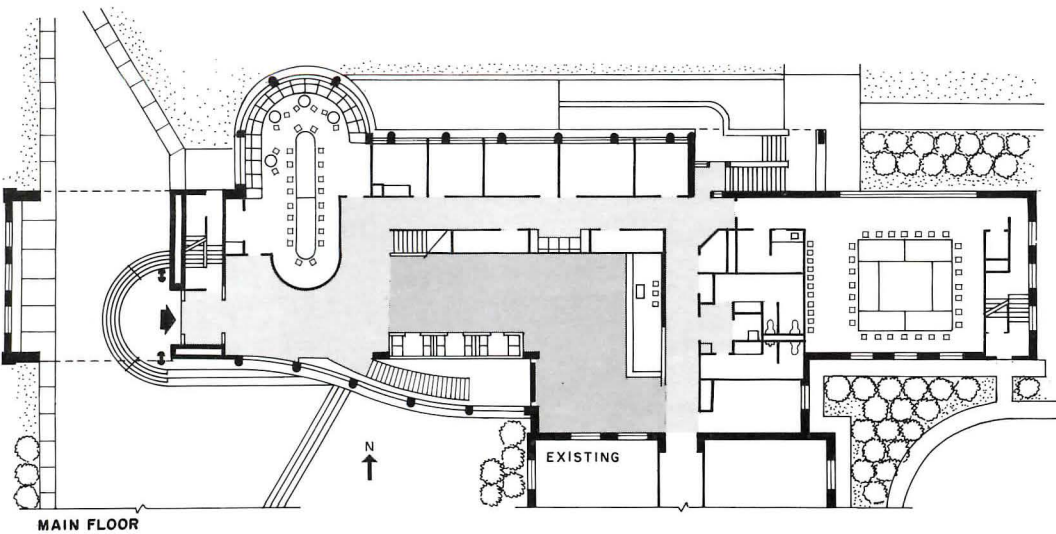
The outward curving south wall of Rockefeller Hall not only smoothes the transition to Silsby, which it slips into by way of a full-height window, but creates a top-lit well that permits the stair to classrooms below to slide unobtrusively past the L-shaped three-story atrium (photos opposite). In addition to providing an assembly and lounge/study space, the central Forum is the link to upper floors in Rockefeller Hall and, via balconies, to Silsby as well. The juncture with Silsby is undisguised, and windows in the original exterior wall join the balconies as overflow vantages for activities in the hall. Apart from the Forum, major ground-floor spaces include Morrison Commons (below left), an informal meeting room and coffee lounge whose elliptical form figures prominently in the building's north facade, and the larger, more formal "Class of '30" seminar room (below right). On the lower-level classroom floor, paired 75-seat lecture halls (bottom right) are steeply raked and horseshoe-shaped for maximum interaction. The third teaching space is a more conventional 125-seat auditorium (bottom left).
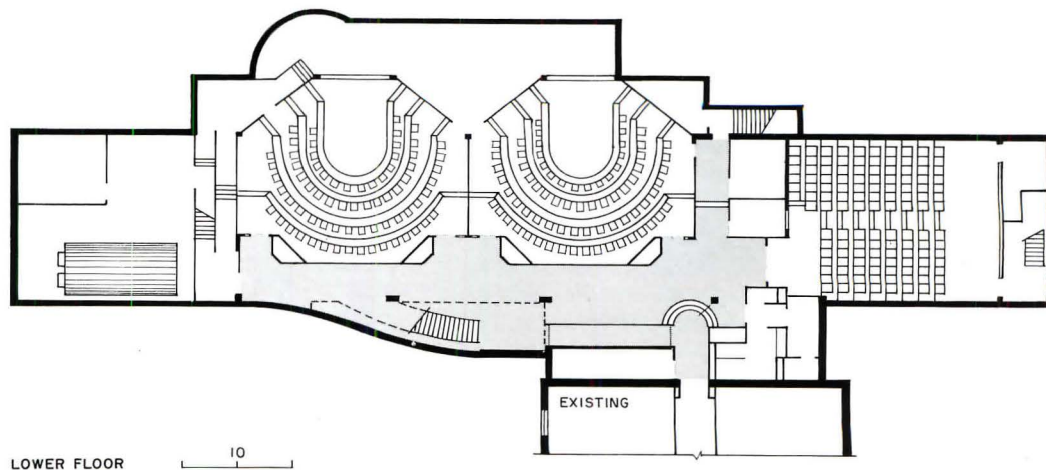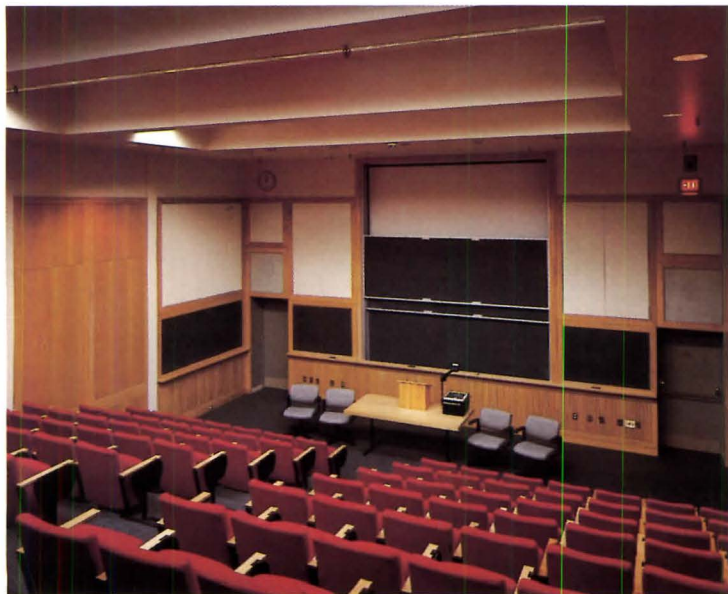
LOWER FLOOR

10

EXISTING

The Nelson A. Rockefeller Center for the Social Sciences
Dartmouth College
Hanover, New Hampshire
Owner:
Dartmouth College
Architects:
Prentice & Chan, Ohlhausen—Lo-Yi Chan, partner-in-charge; Andrew Goldman, associate; Clarese Peterson, interior designer

Landscape architects:
Peter Rolland & Associates
Engineers:
Robert Silman Associates (structural); Dufresne-Henry, Inc. (mechanical)
General contractor:
Trumbull-Nelson Construction Co.

The new MOMA

Expansion and renovation of
The Museum of Modern Art
New York City
Cesar Pelli & Associates,
Architects
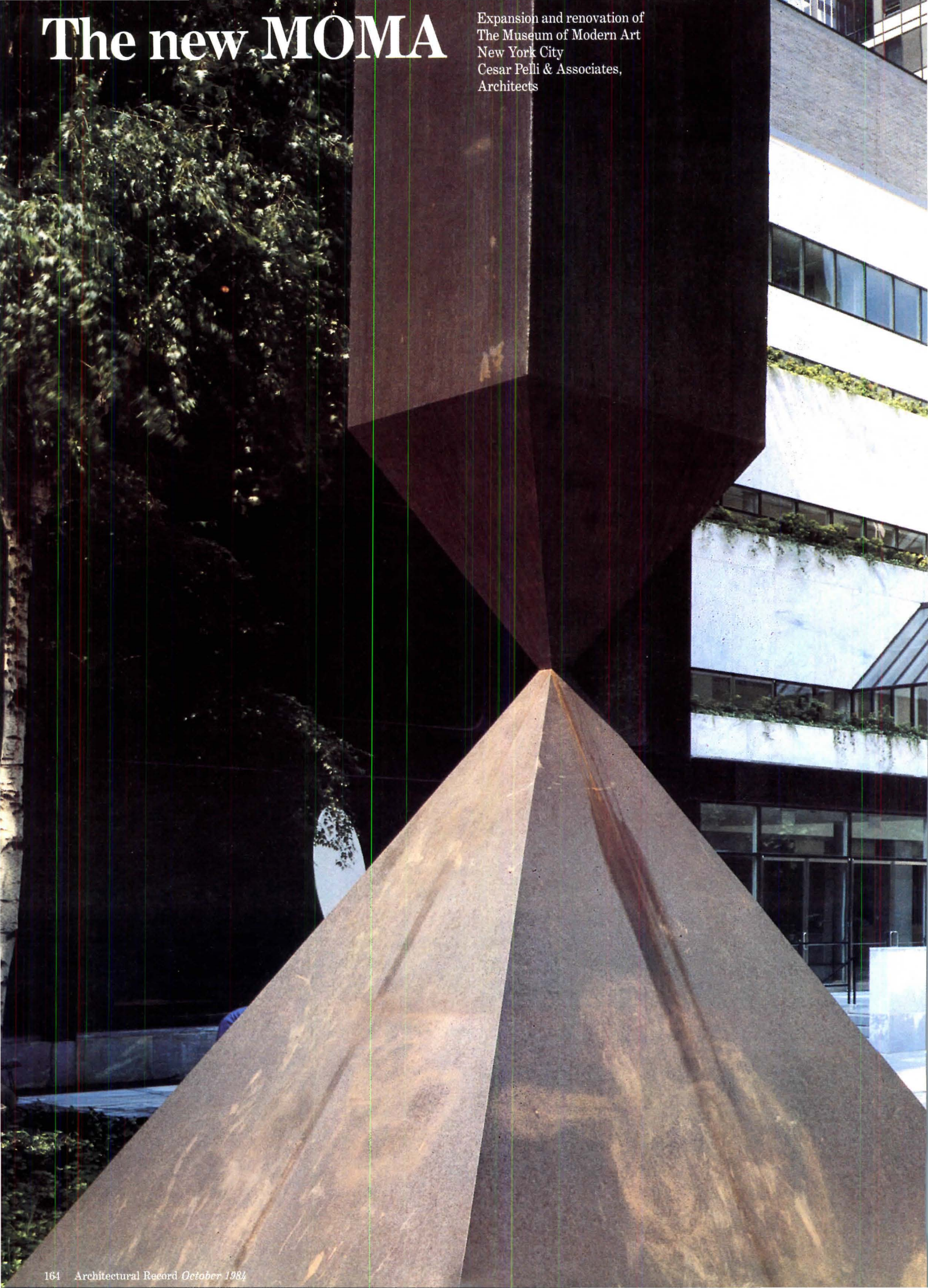
Modern architecture for modern art

The verdict is in. A sample of reactions from typical MOMA fans to the expansion and renovation of their favorite museum goes something like this: "I know it's bigger, but it seems the same, yet somehow improved. And the garden is still there, as lovely as ever. It's wonderful to study the sculpture as you move up and down the escalators in the new glass hall. I think the other end of the garden is a better place for the cafeteria and it was a good idea to bring the members' dining room down from the penthouse and put it in the garden too. Also, I'm glad they kept the old International Style front. It always meant MOMA to me. The tower? Oh yes the tower. I don't notice it." Asked for general comments on the new building, comes the answer: "What new building?"

This public response to his years of extremely complex architectural work on the museum pleases MOMA's latest architect Cesar Pelli very much. The attitude of some of his fellow professionals, however, baffles him. "Every architect," says Pelli, "is trained to expect a new building to make a statement. In the case of MOMA it seemed best to disregard this rule. We decided that the new additions would very purposefully play a background role to the 1939 building designed by Philip L. Goodwin and Edward D. Stone. Architects understand that, they appreciate that, but then they say 'your building doesn't really have enough pizzazz.' But if it did, how could it be a background building?"

At the beginning of the design process, not everyone favored the preservation of the Goodwin/Stone facade, approved the background building concept or agreed with Pelli's positioning of the tower. "Not everyone" was a group of four distinguished New York architects, each disqualified to be the new MOMA's architect because he had already been named a MOMA trustee. Thus benched, presumably against their wills, Edward L. Barnes, Gordon Bunshaft, Philip Johnson and the late Wallace K. Harrison were expected as trustees to review Pelli's work. Because for the first time the museum was to be revamped completely, the four architects urged Pelli to consider giving MOMA a new, unified image and particularly a unified facade on West 53rd Street. What was taking place inside, they argued, should be expressed on the outside.

Pelli, however, considered the Goodwin/Stone building and its additions—three wings and the Abby Aldrich Rockefeller Sculpture Garden by Johnson, all done in a late Miesian style, and the former Whitney, also Miesian and designed by Auguste Noel, to be an architecturally and historically significant collection of buildings. Pelli's design called for the destruction of Johnson's narrow west wing to make way for the tower and the extension to the west. It included the transformation of his garden wing into a restaurant block. The other buildings were to be kept, their facades intact, and the garden was to be encroached upon as little as possible.

The tower was controversial from the beginning. MOMA had to go to court to win the right to build it, arguing that the museum could not serve its ever-growing public, display its increasing collections and continue to maintain itself without the monies such a use of its air rights would produce. Many New Yorkers continue to believe that it is wrong to build any kind of skyscraper in mid-block on a narrow crosstown street. Trustee Barnes, who shares this view, argued that the former Whitney should have been torn down and the tower placed on its site. The tower would have been as wide as the Whitney and could have formed a direct symmetrical relationship with the garden.

Pelli believed, however, that the tower thus positioned would have overwhelmed the garden and, additionally, destroyed the scale of West 54th Street which it would have abutted. Long before the MOMA tower was considered, he points out, West 53rd Street had lost its residential scale. CBS and ABC had built their office towers, Tishman's 666 was in place and St. Thomas's Church and the Donnell Library could not pass for town houses. If a tower must loom, urged Pelli, it should do so on West 53rd Street, where the institutional buildings were, and not on

West 54th which still has a row of lovely town houses and is one of the more beautiful streets in New York.

As it turned out three other trustees, Blanchette Rockefeller, David Rockefeller and William Paley backed Pelli's scheme, tower placement and all, thereby ending the discussion. They made a good decision. It was economical to conserve what had already been built, proper to oppose the concept of a unified facade, judicious to respect the importance of landmarks of our recent past, wise to preserve precious air space and light above the MOMA garden and correct to put the tower in the corner where it belonged.

The principal new construction comprises the tower, the new west wing which forms and extends beyond the tower base, the new glass-enclosed circulation spine at the conjunction of the Goodwin/Stone building and the garden known as the Garden Hall and the new restaurants. "In everything we did," says Pelli, "we tried to achieve an architectural relationship with the portions of the museum that were to remain. These elements are important prior examples of Modernism, part of that stream and tradition. We hope we have designed a building that interweaves in a very harmonious and civilized way with the rest. We not only interwove the forms, but also the underlying principles and attitudes that exist in the earlier work. As you look about at what remains of the old MOMA you will see pieces that are Bauhaus-like and others that look like the Dutch and Scandinavian architecture of the '20s and '30s. If you take away all the ideology and just look at the formal characteristics of the work of the pioneers of the Modern Movement, you will see that they are responding to very well-defined artistic impulses—those that are behind the paintings of Mondrian, Picasso and Jackson Pollock as well as behind the buildings of Goodwin/Stone and Philip Johnson. Those impulses are everywhere in the architecture of the museum and very much alive."

Pelli, however, made no attempt to directly historicize. In other words he did not make specific quotes from the work of the pioneer Modernists nor from Goodwin/Stone and Philip Johnson. He points out: "I personally don't like to do that. When you start making purposeful quotes, you get taken by them and the desire to be authentic to the quotes becomes overwhelming. And I think that this has done great damage to the work of some very well-known architects. I think really good architecture never quotes explicitly. You may see in the work of Michelangelo the whole Renaissance tradition. You can see Brunelleschi in it, but never as an explicit use of Brunelleschi. The ideas are in the air. They become part of the clay you have in your hands. But once I realize I am doing something that looks like something else, I usually abandon it, or put it aside, because then I am not myself and I must be completely responsible for what I do. I cannot shed off some of my responsibility and say that this was Schinkel's fault because he did it first. Furthermore, you cease to work properly as an artist should. You start to work like an archaeologist. Occasionally you may take a fragment and give it a place, but it should be somebody else's fragment. And it should be separable, detachable."

In using what were essentially the fragments of the existing MOMA, Pelli kept them distinct and discrete. One exception, however, was the garden facade of Johnson's east wing. The facade itself is intact, but Pelli extended the ground-floor bays with their almost black windows and dark steel frames to form a new arcade leading to the restaurant wing, continuing them to enclose the first-floor cafeteria. This fenestration is a literal copy based upon Johnson's original working drawings for the east wing. The new enclosure thus formed of the eastern end of the sculpture garden is beautifully handled. It was never quite right before.

Pelli's interior spaces are purposefully neutral in the tradition of MOMA. They were constructed on a tight budget and lack the refinement of detail to be found in such museums as Hans Hollein's at Mönchengladbach, for example. MOMA's director, Richard E. Oldenburg points out that there was little money to spare: "Obviously we wanted to control costs as much as we could to enable us to increase the endowment necessary to support a museum now twice its size. The extension and renovation grew out of the fact that we needed space desperately, but we also needed to figure out how to support that space once we had it and to keep adding to our collections. The realities were there from the beginning. We didn't want to start with something very grand, have panic set in and start cutting everything out. We did very little that we hadn't planned from the beginning. We left out what didn't seem practical. But on the other hand, the museum long ago had made a virtue out of the vice of being poor. The museum's style is a very simple style—it would look very odd in the MOMA context if we had used complicated moldings and lighting effects, or if expensive materials were introduced. If we could have afforded it we would have loved to have hidden the air ducts, but parenthetically, I also hear that some of the hidden systems have their problems. Everybody would like to have had less cluttered ceilings in the galleries. But the lighting is the kind of lighting we are satisfied with. I think we made an esthetic out of cheap. Our galleries are minimally detailed. Almost loft construction. Even our special places, the members' dining room and the theater, for example, are elegant without being luxurious. I also think there is a certain honest value to this even if it weren't a necessity. I think for an institution that always has to struggle to survive and gets assistance from the public sector and is always hat in hand to contributors and members it would be unseemly to spend huge amounts on things that are not strictly necessary. So I am happy with the level of finish."

The controversial tower presented a different set of problems. In designing it, Pelli had two objectives which were contradictory. First, he wanted to put it in the background so that it couldn't be seen. Second, he wanted it to be very beautiful and sophisticated. His responsibility included its placement and curtain wall, in other words, its exterior appearance. (The interior configurations and the structural and mechanical aspects of the tower were handled by Edward Durell Stone Associates.) Developing the curtain wall was a slow, deliberate and intense process. Said Pelli: "I personally spent hundreds and hundreds of hours analyzing slightly different shades of color." At the beginning Pelli and his team tried much brighter colors than they were to eventually use, particularly on the west wing at the base of the tower. In that early stage they thought that bright colors would make for a more interesting building and a livelier street. They found, however, that the Goodwin/Stone facade could not stand up to it. The International Style facade turned out to be not as strong as they thought. They found that to make it stand out, a receding background was required. Old photographs showed how it had popped out against its brownstone neighbors and it could be seen before the west wing was demolished, that Johnson's two black additions, one on each side of the emblematic facade, made an effective frame. So Pelli moved to dark brown glass for the base and desaturated the colors in the tower. The glass facade of the Goodwin/Stone building was a dirty greenish color. According to Arthur Drexler, Goodwin/Stone's original glass installation had been linen in shade, but it had started to mildew, and was replaced by the green etched glass. Pelli installed bright new glass matching Goodwin/Stone's original color.
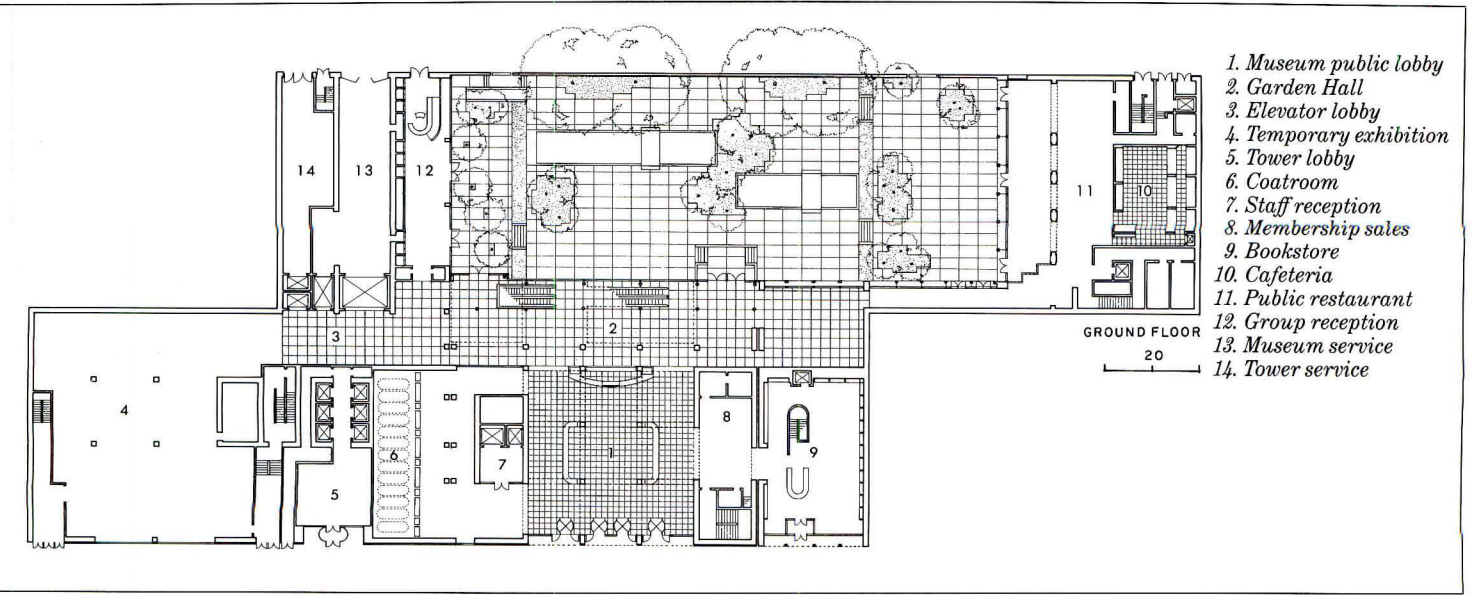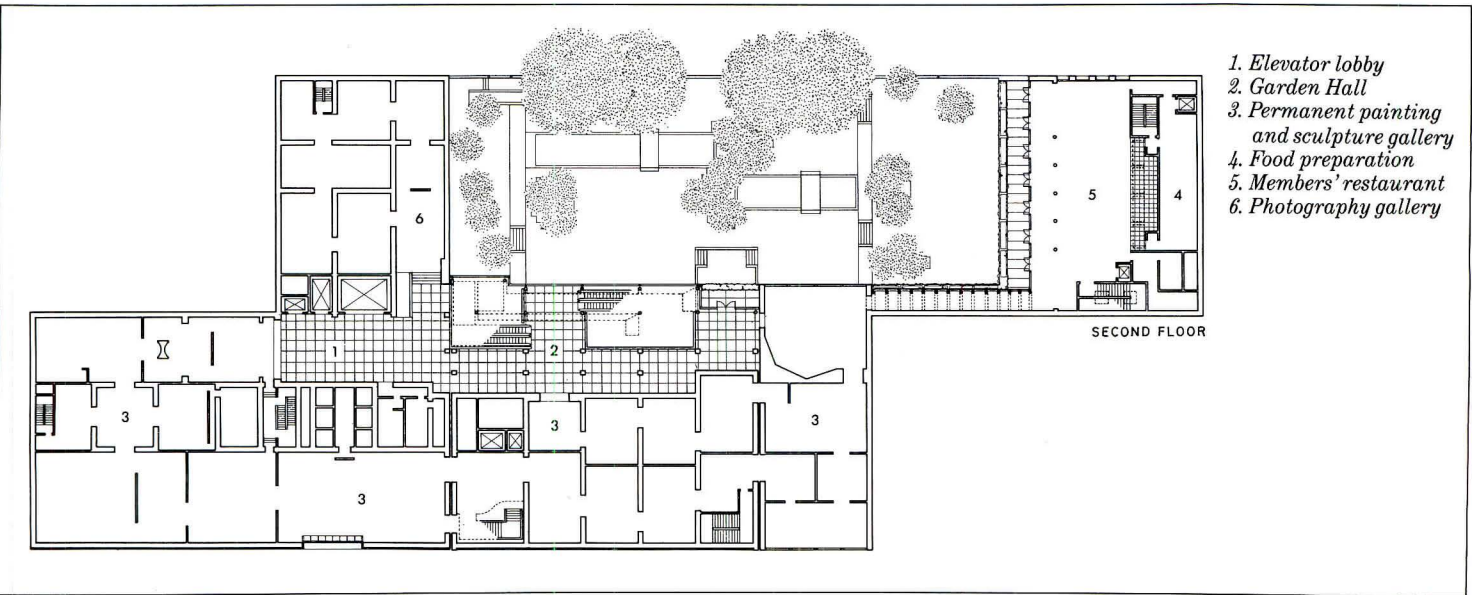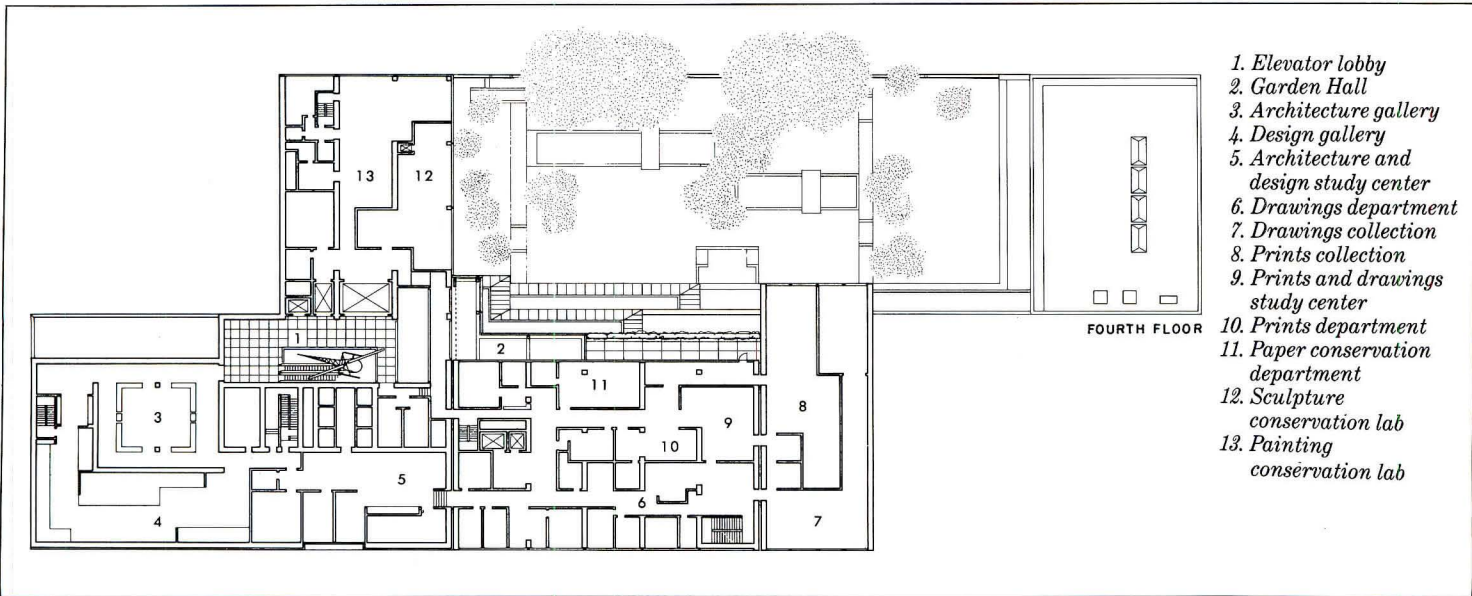
Architecture is sometimes the modest yet exacting task of putting such things right. It is also the demanding challenge of making major interventions that don't show. Both approaches were what MOMA needed and it chose its architect well. Pelli understands this kind of architecture—profoundly. *Mildred F. Schmertz*
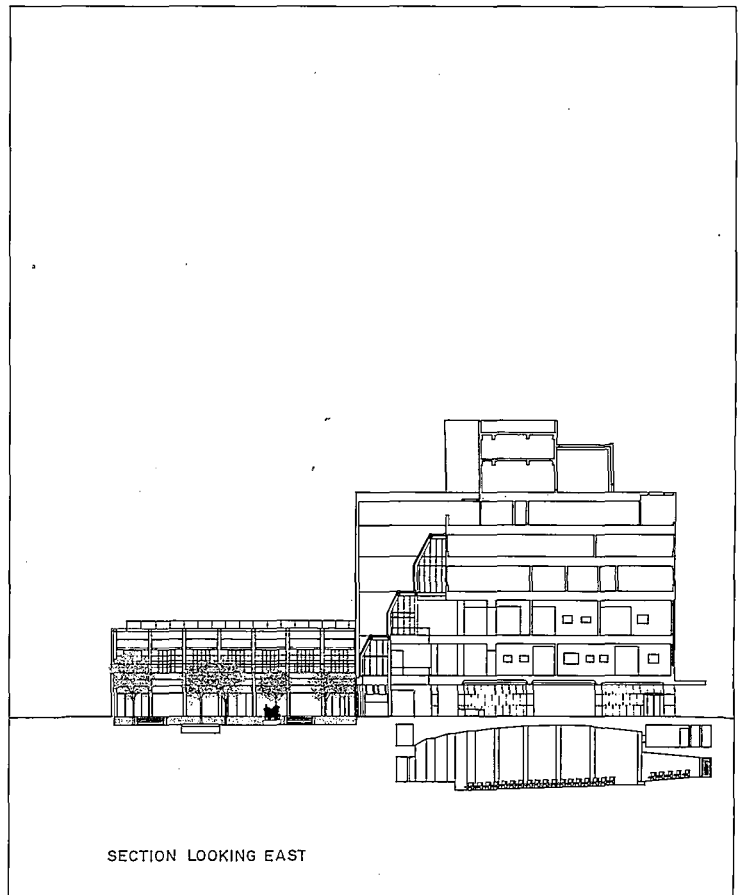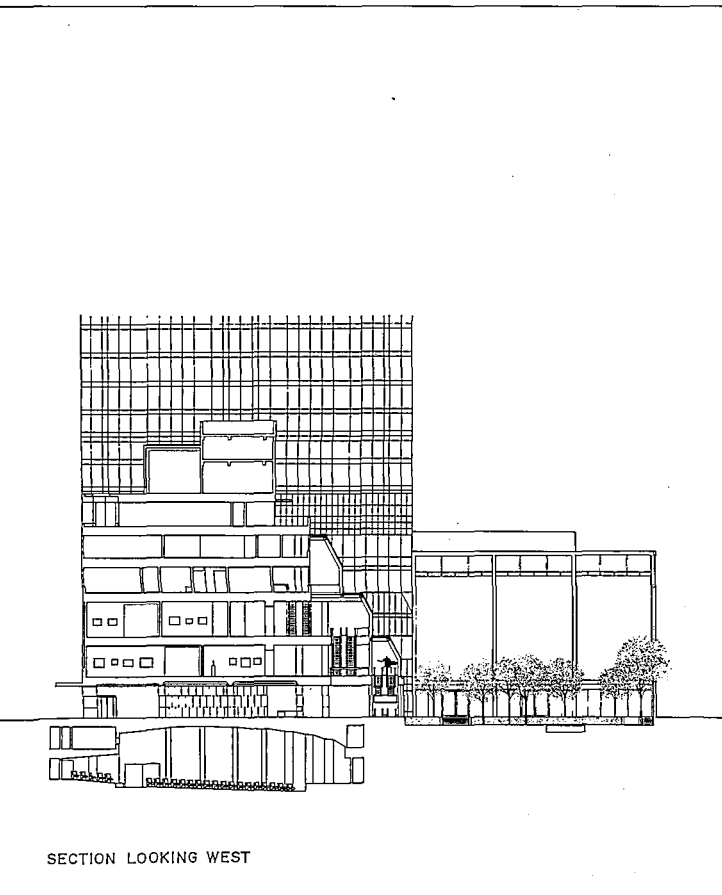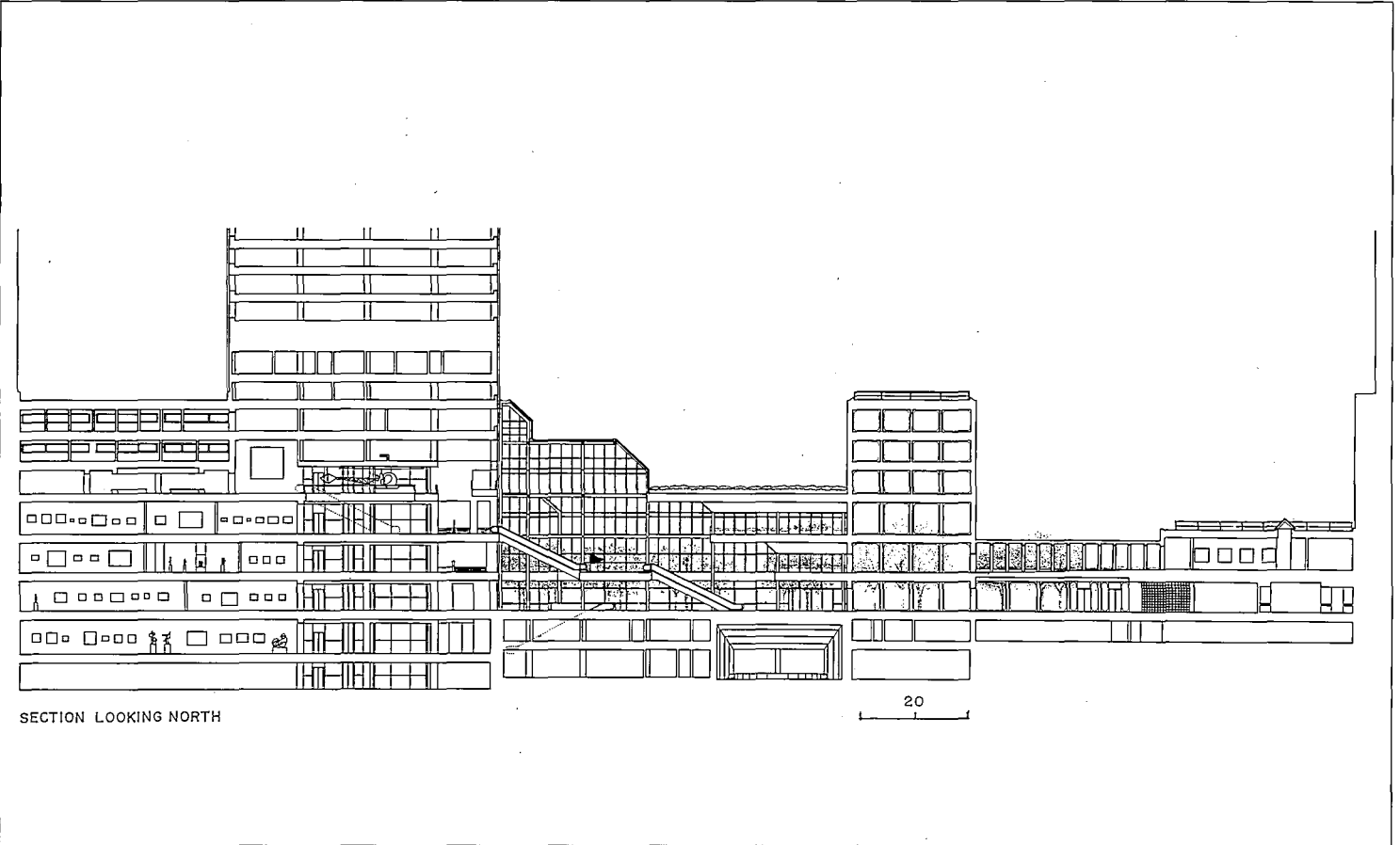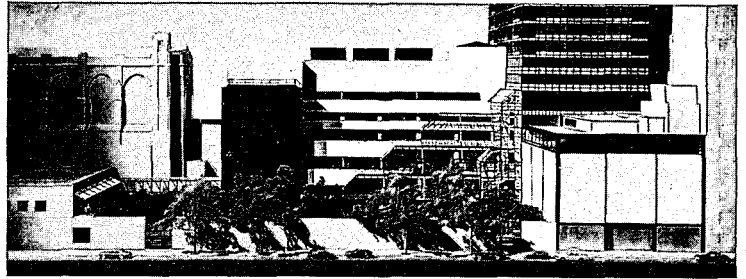
When Pelli began work, MOMA consisted in part of a collection of buildings which could be read as separate entities, but taken together with the sculpture garden were intended to form a late Miesian ensemble—a context in which the early International Style Goodwin/Stone building was treated as a focal point. The orchestration was Philip Johnson's. He designed the two dark wings to the east and west of the Goodwin/Stone facade, an earlier and later version of the garden (both constructed) and a one-story garden wing at the east end. The former Whitney Museum, known as the north wing, was also in the Miesian mode. MOMA additionally owned and used a splendid 53rd Street town house of 1902-3 designed by Richard and Joseph Hunt and several adjoining town houses. As the model photograph (opposite page left) showing the new 53rd Street facade indicates, the Beaux Arts town house and its lesser neighbors to the west were demolished (great public outcry). Johnson's west wing bit the dust too (no discernible outcry). But Pelli's decision to bracket the light and bright Goodwin/Stone facade with dark, shadowy surfaces seems as correct today as when Johnson did it first. The proportions of Johnson's remaining 53rd Street facade did not elaborate upon the module of the Goodwin/Stone front, but Pelli's do. The fenestration geometry of the tower and its base is derived from the International Style front. MOMA's new space has been captured beneath the tower and in the new west wing which extends beyond it. Apart from the tower, the garden side of MOMA (opposite page right) appears open and airy.

FOURTH FLOOR

1. Elevator lobby
2. Garden Hall
3. Architecture gallery
4. Design gallery
5. Architecture and design study center
6. Drawings department
7. Drawings collection
8. Prints collection
9. Prints and drawings study center
10. Prints department
11. Paper conservation department
12. Sculpture conservation lab
13. Painting conservation lab

SECOND FLOOR

1. Elevator lobby
2. Garden Hall
3. Permanent painting and sculpture gallery
4. Food preparation
5. Members' restaurant
6. Photography gallery

GROUND FLOOR

20

1. Museum public lobby
2. Garden Hall
3. Elevator lobby
4. Temporary exhibition
5. Tower lobby
6. Coatroom
7. Staff reception
8. Membership sales
9. Bookstore
10. Cafeteria
11. Public restaurant
12. Group reception
13. Museum service
14. Tower service

SECTION LOOKING NORTH

20

SECTION LOOKING WEST

SECTION LOOKING EAST

Discounting the former high terrace at the east end, the length (east-west axis) of MOMA's garden remains unaltered, its width at the western end is 18 feet less, space sacrificed to the Garden Hall. The café at the west end has been replaced by a lobby for group reception, the bulky, awkward fire tower at the conjunction of the Goodwin/Stone building and Johnson's east wing no longer exists and the former terrace has become the members' restaurant. The pools, bridges, sloping berms and plantings of the garden have been restored in essence to Johnson's beautiful 1964 design, a modification of his first landscape plan of 1953. Sculpture, however, has been rearranged and some additional pieces have been added. At present, the new placements and juxtapositions will need some curatorial pruning and rearranging if the garden is to become as elegant as before.

Cesar Pelli's Garden Hall connects the Goodwin/Stone building and the garden. It is Pelli's single bravura performance for MOMA, the only element among his additions and infills not relegated by him to a supporting role. If the Goodwin/Stone International Style facade, like *Les Demoiselles d'Avignon*, is an unforgettable emblem of MOMA, the Garden Hall brilliantly signifies MOMA's renewal and second beginning. Arthur Drexler, MOMA's director of the department of architecture and design, can't wait until winter. "I think there is a bonus coming. I hope we have one heavy snowfall. The garden in snow is very beautiful and I want to ride up and down in the escalator seeing it in new ways. It should be simply marvelous."

Four stories high with two setbacks on the vertical plane and four on the horizontal (sections preceding page), the Garden Hall (exterior above, interior opposite) has been made as narrow as possible to minimize its encroachment on the garden. The apartment tower rises 44 stories above the new west wing at the intersection of the Goodwin/Stone building and the old Whitney. The cascading greenhouse ameliorates the bulk of the tower and prepares the eye for its vertical thrust. The glass proportions of the Garden Hall and the tower relate to a common dimension, derived from the glass grid of the Goodwin/Stone facade. The museum expansion permits gallery layouts to be more spacious where appropriate, as in the galleries devoted to large Abstract Expressionist works (next two pages).
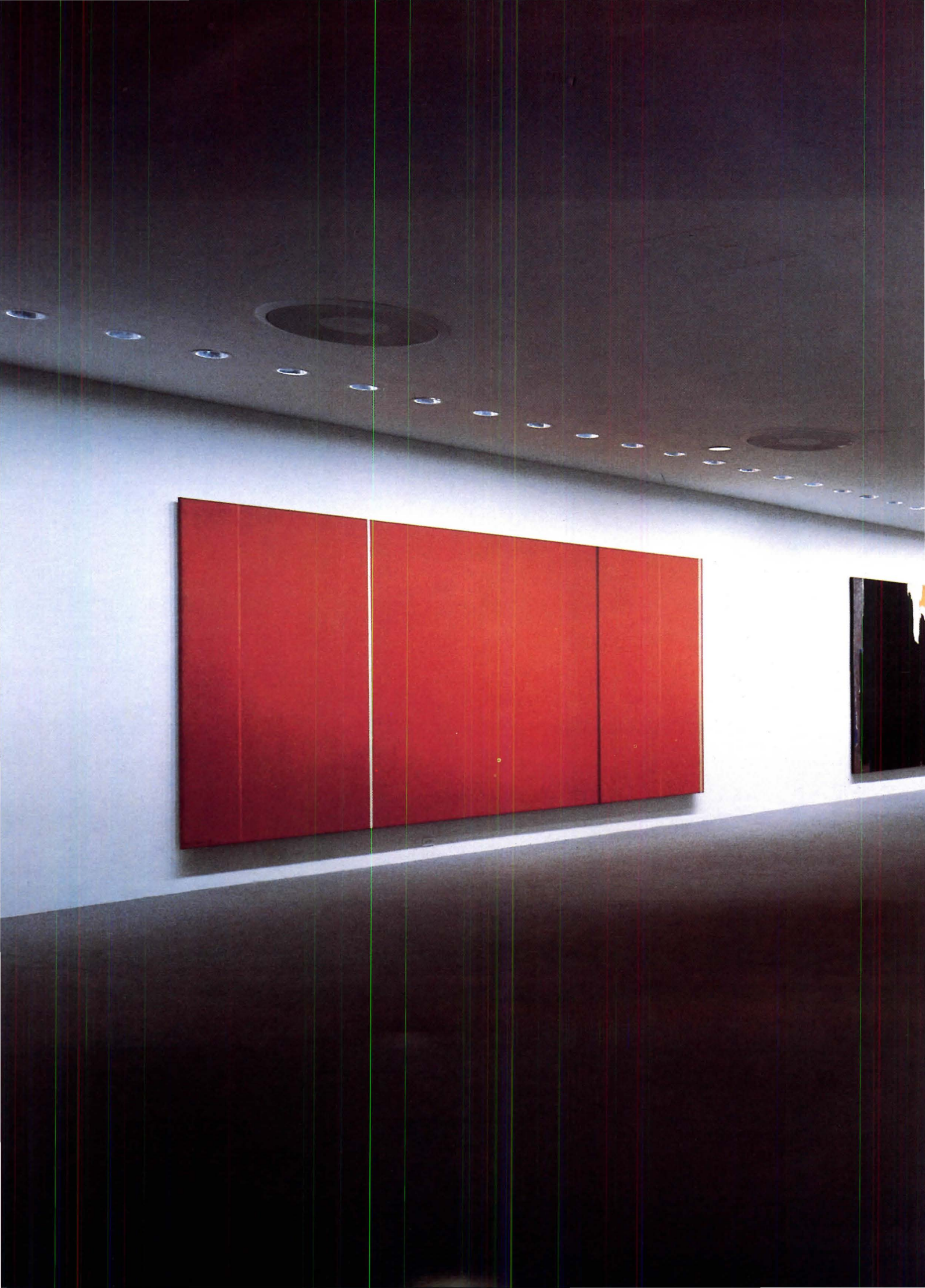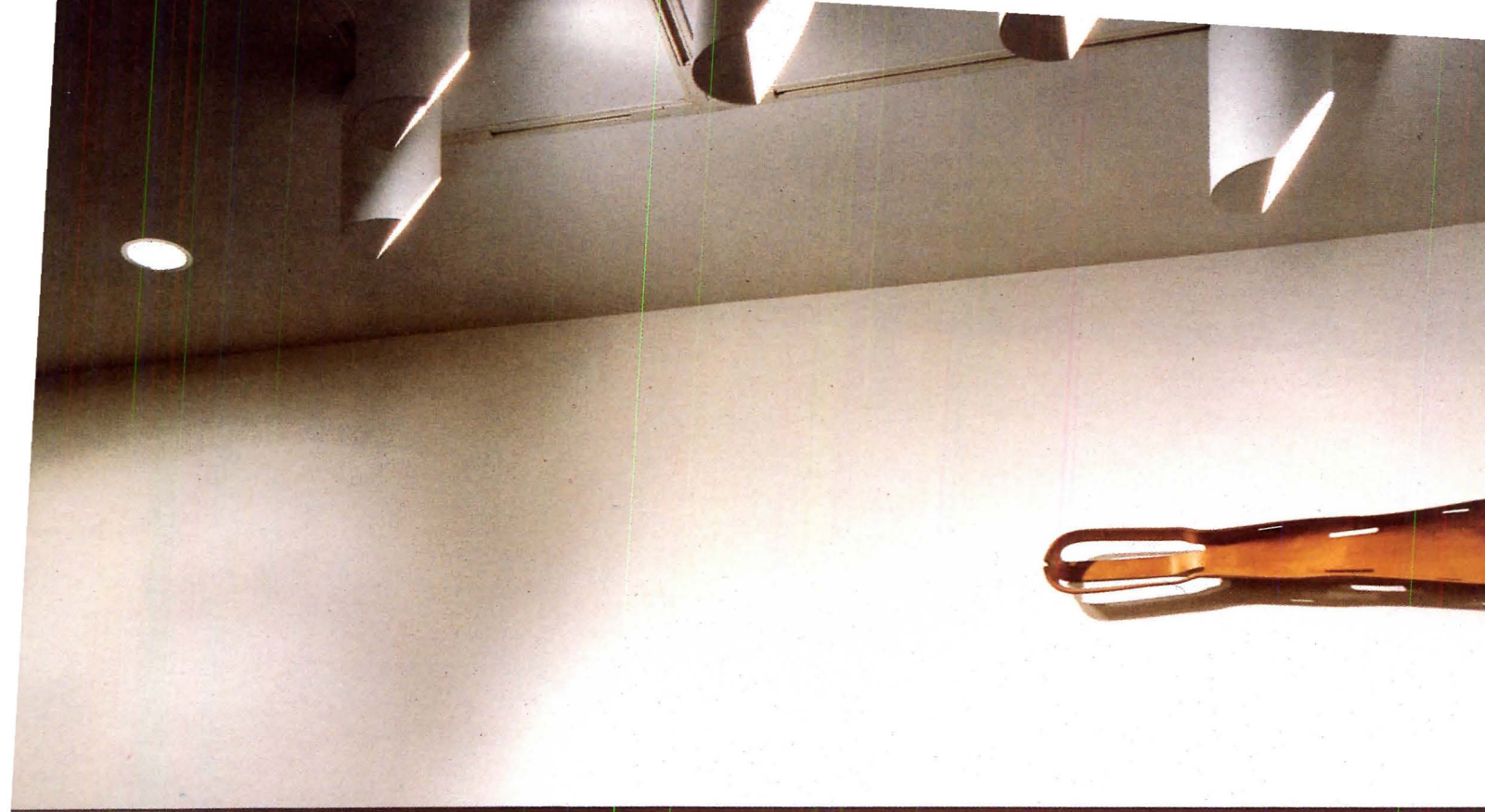
Considering the unparalleled eminence of MOMA's architecture and design collections, and the worldwide stature of its exhibitions and publications, it is a surprise to discover that Arthur Drexler's new exhibition space is only 6,500 square feet, up from 1,700. (Total permanent gallery space is now 67,000 square feet, temporary gallery space, 20,000.)

"It would be churlish to complain," says he. "I don't begrudge the space the others got. Besides, there is no place in this museum where we could show all we have of anything. The purpose of the enlargement of the museum is to have key works always on view."

When Drexler and his fellow department heads made preliminary space allocation studies, they agreed that painting and sculpture from the permanent collection should be exhibited with historic continuity. Other departments would not be permitted to interrupt this sequence. Drexler's department was precluded from being located on the second or third floor. In the end he found the fourth floor to be the best place, "not big enough, but three times more than we used to have." Importantly, the first floor galleries for temporary shows will generously accommodate major architectural exhibitions. Architecture and design has the fourth floor exhibition space to itself. "Moreover," says Drexler, "we have a double height space just beyond the top of our escalator to give people the sense that there is something exciting up there. And it is good for big posters. Furthermore, because we were at the end of the escalator line, I used the space above to hang the helicopter"!

The design gallery (opposite), named for Philip L. Goodwin, displays representative examples of MOMA's permanent collection of furniture and industrial design. The spatial organization and installation is by Arthur Drexler. The architecture gallery (top), named for Philip Johnson, was also designed by Drexler. In a rectangular space demarcated by four columns with interconnecting benches and a recessed ceiling, a collection of models of great works is exhibited under bright spots. Along the walls of the low-ceilinged perimeter a selection of architects' drawings is softly lit. The case filled with gleaming objects of industrial design (above) shares the two-story entrance to the architecture and design wing with a bright red Pinin Farina, a Bell helicopter and some great posters (not shown).

The fragmentary view (opposite) of the West 54th Street town houses as seen from across the terrace of the members' restaurant, merely suggests the vistas of the city that MOMA's rebuilding celebrates. Mammoth sculptures, which seemed too big for the Miesian garden below, used to be exhibited at the terrace level. Although it is a pity that now there is no special setting for the truly huge pieces, which presently are intermixed with smaller works to the detriment of some, the former terrace always seemed isolated, not quite in the garden, not really a place to go. At one time MOMA considered adding seven stories of gallery space to this wing, a solution for their expansion problem that would have greatly reduced the sense of spaciousness in the garden, while literally constricting it. Furthermore, the floor areas would have been too small for exhibition purposes.

Architect Cesar Pelli's decision to consolidate MOMA's dining facilities in this wing by adding only one story was manifestly correct esthetically and functionally. The sculpture garden, at last, is beautifully enclosed at its eastern end by a pavilion of the right scale. The members' dining room, formerly a remote and neglected inhabitant of the top floor of the Goodwin/Stone building, is now just off the garden in the midst of the excitement. Pelli's handling of the former garden wing is characteristic of his entire approach to the problem of renewing MOMA. He has succeeded in the exacting architectural task of making subtle, yet momentous changes. He has added to, adjusted and repositioned MOMA functions in ways that have protected and superbly enhanced qualities that were already there.

The members' dining room (top) overlooks a terrace (opposite) and faces the sculpture garden. It is located directly above the public cafeteria visible behind a glass block screen (above). This restaurant also faces the garden. The members' dining room evokes early Modernist themes—a bit of Charles Mackintosh and something of the Viennese Secessionists—although Pelli insists that this was not deliberate.

Whatever its provenance, it is a lovely room, one of the handsomest restaurants in New York City. The prospect of eating there should entice many a non-attached MOMA visitor to sign up and join the family.

River Crest Country Club
Fort Worth, Texas
Taft Architects

Playing by the rules

Social calamity struck Fort Worth in 1981 when the River Crest Country Club burned to the ground. The 70-year-old clubhouse had been a gathering place for prominent local families since their great-grandfathers first trod the fairways and staked claim to mansions in the surrounding uplands. To the present inhabitants of these elegant purlieus, life without River Crest was as unthinkable as Texas without oil or a debutante unwilling to curtsey. "Why can't we just rebuild River Crest as it was?" some 1,100 members lamented in unison to a specially appointed building committee. Nostalgia aside, there was little sense in resurrecting what had in reality been an architectural hodgepodge, awkwardly laid out and very cramped. The clubhouse erected in 1911 was a handsome Craftsman Style timber lodge, whose sturdy simplicity disappeared over time amidst a jumble of ad hoc remodelings. By the mid-1950s, this overgrown bungalow had been totally reclad in the anemic brick-and-white-columns neo-Georgian favored by funeral parlors and genteel motels (photo opposite top). According to a questionnaire filled out by club families after the fire, most remembered River Crest as "colonial," and this was the style they hoped would rise from the ashes beyond the 18th hole. Though many of those consulted could not explain precisely what "colonial" meant, they knew for sure that anything "modern" was anathema.

In its quest for a suitable architect, the building committee was honor-bound to respect these sentiments. "We felt that many firms could design a clubhouse our members would be able to live with comfortably," reports R. W. Moncrief, the committee chairman. "But we wanted something more than just a place to take off your golf shoes and have a drink. We wanted a building that would give people here the same sense of pride they feel about Louis Kahn's Kimbell Museum." The committee was particularly taken with the recent accomplishments of Philip Johnson (architect of another Fort Worth museum, the Amon Carter). Johnson volunteered his own ideas about appropriate variants on Georgian domestic style but declined the commission, pleading an already full agenda. "You can't follow a project like that long-distance," he reasoned. "It's worse than doing a house: you have 1,100 clients, every one knowing just what to do." Whom would he recommend? Johnson instantly proposed Taft Architects, a young three-man firm in Houston, as the Texans most likely to design "a country club that looks like a country club."

Moncrief called on Taft two days later. "When I asked them to draw us a rendering, as other architects had," he recalls, "John Casbarian told me, 'We simply can't. Did Philip Johnson do a rendering for you?' I thought, 'Well! Who is some pup in his 30s to be saying this?' Of course, he was right—Johnson hadn't—and I said, 'Fine, I'll be back in three or four days if you'd like to show us what you can do.'" By the time Moncrief returned, Casbarian and partners Danny Samuels and Robert Timme had compiled a slide show tracing the historical development of the country club as a building type, and demonstrating its sources in a tradition of country house design that extends from Palladio to Jefferson, Lutyens, and beyond. "This was the first time we'd ever felt any constraint from a client on the architectural language we had to adhere to," says Casbarian. "What we had to do, we believed, was point out where this 'colonial-Georgian' style came from, and how and why it had been transformed." Rather than arbitrarily seizing a single prototype and adapting it to River Crest, Taft elected to set forth a range of options for the client's response—or as Timme explains it, "to provide images of many places with a *memory* of the kinds of activities and atmosphere members associated with the club." Even without the reassuring concreteness of a rendering, Taft's illuminated typology convinced the building committee, and the entire membership, that here were architects who understood the River Crest sensibility. After the contract was signed, this meeting of minds continued . As is their wont, Taft began by assembling three-dimensional schematic models of alternative layouts, as a point of departure for discussion with the

client. Given the complex network of public spaces, athletic facilities, and service areas built into the program, this dialogue was very helpful (never more so than halfway through design, when a cost-conscious River Crest insisted that the floor area be reduced by 15 per cent).

Remarkably, in light of Philip Johnson's caveat, the final product betrays few of the unhappy compromises often associated with participatory design. On the contrary, a rigorous logic orders most of Taft's scheme (plans and axonometric overleaf). From the standpoint of logistics, their cross-axial parti places kitchens and other utilitarian zones where they are most efficient, at the core of the complex. Readily accessible to assembly rooms around the perimeter, and the ballroom directly above, service corridors are nonetheless independent of circulation routes used by club members. Pivoting on four mechanical stacks that emerge from the roof as chimneys, the geometry of the plan organizes the complicated array of interior spaces into a coherent processional sequence. Enfilades link suites of rooms and connect them in turn, through arcades, terraces, and porticoes, to the landscape. To minimize encroachment on outdoor amenities undamaged by the fire, the new clubhouse occupies the site of the old. On the east and west, Taft's axis aligns with fairways bordered by avenues of live oak and ash, and on the south, with a swimming pool and adjoining pavilion that also survived the blaze.

The preservation of these environs limited the area available for the building itself, necessitating the distribution of 51,000 square feet of program space on three stories. In order to stay within the bounds of an appropriately domestic scale, the architects depressed the ground floor one-half story below grade, and housed the ballroom in the lofty attic of a massive hipped roof. Country house architects in the past might have relegated this ample garret to nurseries and servants' quarters, or perhaps a billiards room, and would have deplored the solecism of a kitchen at the heart of the plan. In Taft's hands, however, the unorthodox layout creates a dramatic setting for pomp and circumstance (see pages 186-187). The kitchens become a podium for the ballroom, elevating this vaulted aerie to command the best views for miles around—and furnishing a splendid excuse for the grand staircase from which River Crest brides toss their bouquets, and celebrants of every age enter and exit in the style to which they are accustomed. If a few too many angles break the flow of the staircase, and a jarring grid of acoustic panels interrupts the graceful arc of the ballroom vaults, no matter; the ensemble is still a fitting backdrop for anyone's fantasies of Scarlett and Rhett or Fred and Ginger.

The bow to precedent embellished with an inventive flourish, which distinguishes Taft's interior planning, also marks their approach to the externals. "History for us is a modifying, not a generating, force," explains Danny Samuels. "We don't want every detail to be 'read' as a superficial reference to the past." Regarding the personal reinterpretation of the classical canon apparent in River Crest's brick-and-terra-cotta facades, Robert Timme comments, "We saw this building as an opportunity to maintain the level of abstraction that is possible in architecture, and still have the depth of wall surface and detail that sometimes precludes this. We want people to understand spaces and volumes *through* detail." To that end, Taft skillfully tackles what Lutyens called the"high game" of classicism, and plays with spirit. Whether enriching a rusticated basement with an unexpected inlay of green tiles (photo page 184), turning out columns-sans-capitals, or contriving a porte-cochère that seems to have exploded out of the facade behind it, Taft in effect establishes order without the Orders. For all their originality, though, these inventions never deny the archetypes from which they ultimately descend. Such sportive tributes to tradition deserve applause at River Crest since they reaffirm a principle dear to any clubman's heart: one can stretch the rules to enliven a friendly game, but break them and everything is lost.
Douglas Brenner

Taft Architects' $7.5-million structure stands on the site of an earlier clubhouse destroyed by fire (photo left). The client's program insisted that the new building recall its predecessor's "colonial" style (the legacy of a 1950s remodeling of a 1911 Craftsman Style lodge) and honor the domestic scale of older mansions in the nearby streets of Westover Hills. Taft's design draws on the same Anglo-American heritage that inspired the lost clubhouse, though the striking contrast between the two buildings illustrates the enormous range of expression possible within the classical language. Oriented to an extant swimming pool and allées of trees (site plan overleaf), the massing of Taft's cross-axial composition harks back to Palladio, Jefferson, and McKim, Mead & White, while the robust, sculptural modeling of the facades and an emphatic roof silhouette bring Lutyens to mind. The allusive use of architectural history reflects the social evolution of the American country club—a place where the new world can emulate the rustic retreats of the old, but temper ceremonial etiquette with relaxed hospitality. Like any suburban house, River Crest has a formal "front door"—the porte-cochère on the west facade (large photo).

© Paul Warchol photos

Taft played down the apparent bulk of the three-story clubhouse by sinking the lowest level one-half story below grade. Projecting bays reinforce the orientation of each facade to the adjacent grounds, above all on the western entrance front, where the extrusion of a brick frontispiece beyond sections of raw concrete structure implies that the porte-cochère has been formed by thrusting a colonnade out of the wall (detail opposite top; a fabric canopy over the porch extends this visual conceit). The extroversion of the building's perimeter is countered by a strongly centralized parti. Whereas the kitchen and extensive service areas specified by the program fill much of the building's core, a grand staircase and upper-level ballroom (photos pages 186-187) supply the conspicuous centerpiece required for public areas used by

MAIN FLOOR   10

BALLROOM FLOOR

SITE PLAN   50

LOWER FLOOR

1. Loading dock
2. Receiving and storage
3. Employee dining
4. Laundry
5. Mechanical
6. Bakery
7. Employees' lockers
8. Members' entry
9. Men's locker room
10. Women's locker room
11. Administration
12. Card room
13. Exercise
14. Terrace
15. Cocktail lounge
16. Dining room
17. Private dining room
18. Lobby
19. Kitchen
20. Tavern
21. Mixed couples
22. Men's card room
23. Lounge
24. Pantry
25. Ballroom
26. Mechanical and storage
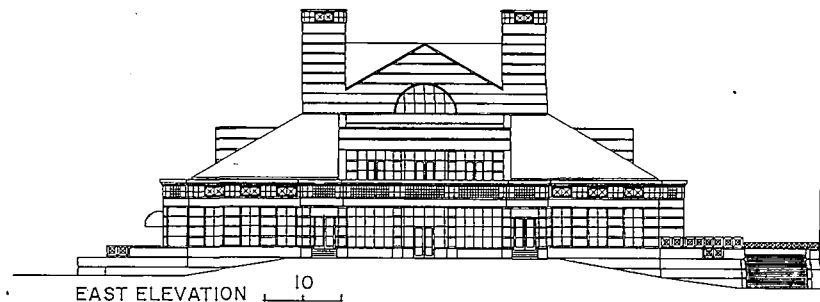
EAST ELEVATION   10
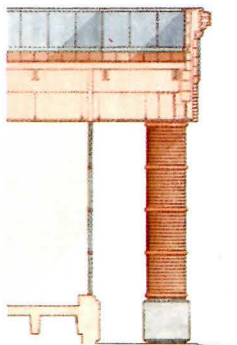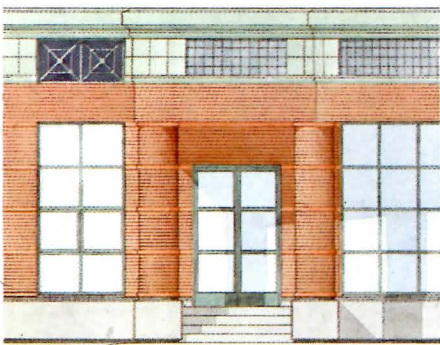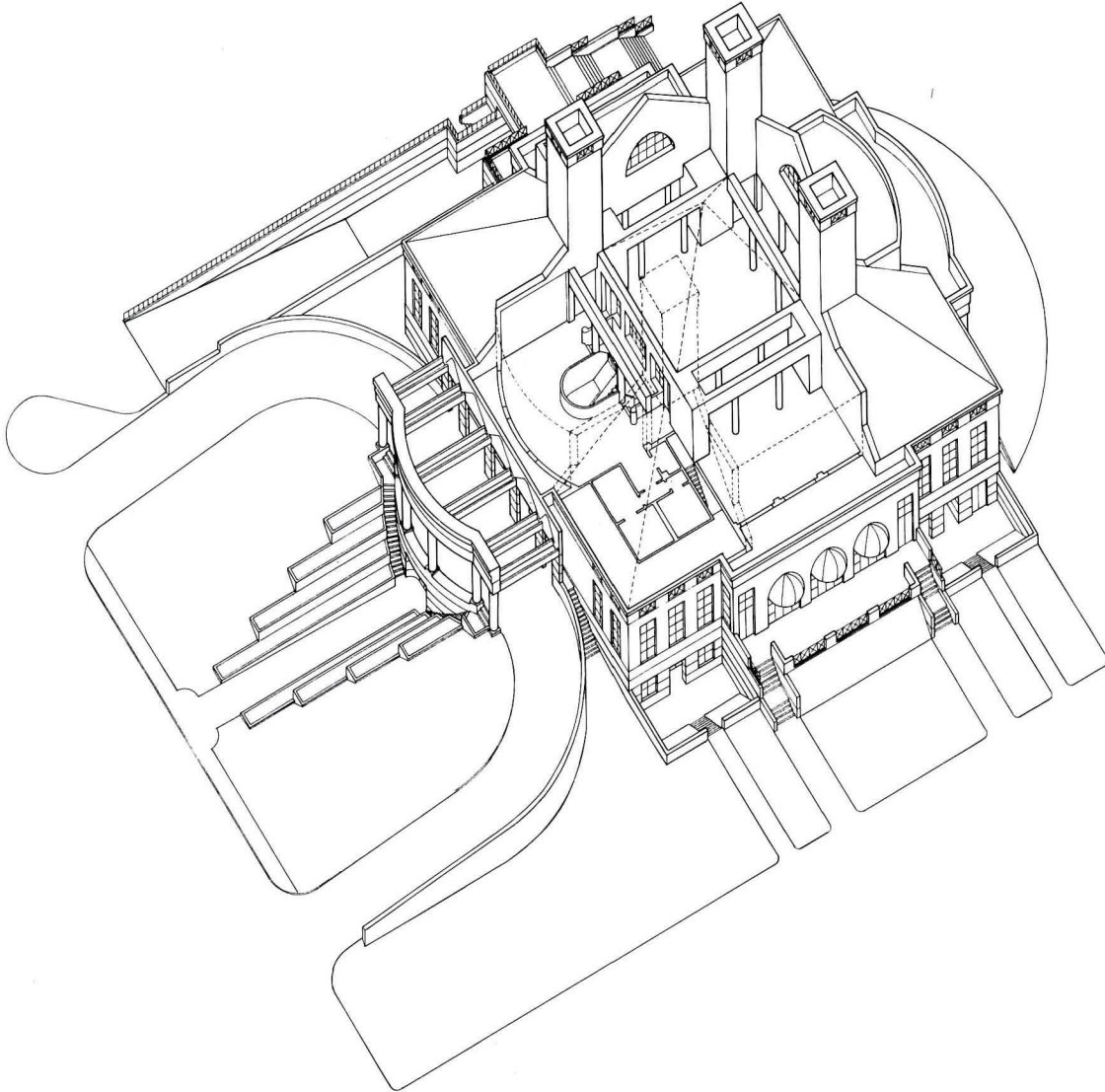
The clubhouse is framed in steel and cast-in-place concrete, and clad in terra cotta and brick. Using color renderings à la Beaux-Arts (page 183) and large-scale mockups, Taft studied the niceties of hue and texture, and details such as custom-made lanterns, that lend the building skin its apparent density. More than an attractive appliqué, this surface treatment articulates massing and volume, whether seen from a distance or close up. The broad band of the cornice binds together disparate bays and terraces, while weaving its own subtle pattern. Recessed bands of small green tiles define the "joints" of a rusticated basement (opposite). "Of course, most club members don't talk about rustication," notes building committee chairman Moncrief, "but they say, 'Isn't that tile pretty. I like the way it keeps the concrete from looking like, well, concrete.'"
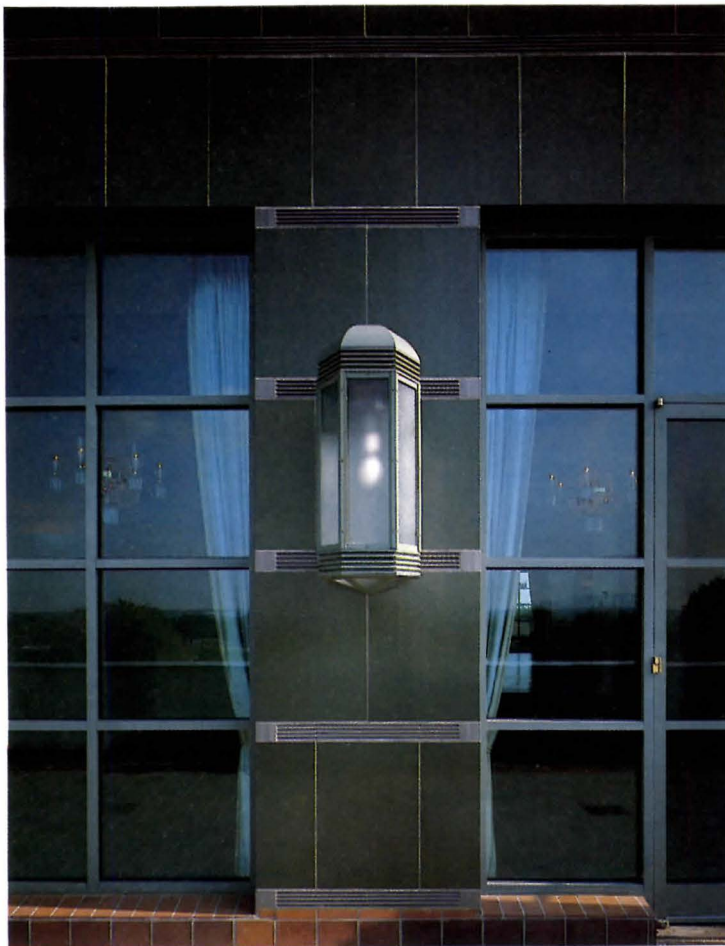
The pervasive influence of Lutyens is especially pronounced in the banded vaults of the "mixed couples room" (top left). Here, as throughout the club, furnishings were selected by interior designer Mark Hampton. His décor allows for the future addition of genuine period pieces such as the Regency portrait, lent by a member, that graces the head of the stairs (bottom left). The landing doubles as a waiting lounge before large receptions, while the ballroom itself can be subdivided for small parties by extending movable walls between the coupled columns. Pantries, storage, and mechanical systems are tucked under the eaves, permitting generous access to roof terraces and views. The dark panels set into the clerestory vaults are acoustically absorbent. When the dance floor is full, the hall can accommodate 300, a respectable turnout for most cotillions.

River Crest Country Club
Fort Worth, Texas
Owner:
River Crest Country Club
Architects:
Taft Architects—John J. Casbarian, Danny Samuels, Robert H. Timme, partners; Suzanne Labarthe, Larry Dailey, project assistants; Charlie Thomas, Natalye Appel, Michael Underhill, Janet O'Brien, Josephina Diaz de Leon, Randy Gay, support team
Associate architects:
Geren Architectural Division/CRS Sirrine, Inc.—Charles W. Nixon, project director; John R. Moore, project architect

Engineers:
Geren Architectural Division/CRS Sirrine, Inc.—Harold E. Hatfield (structural), John W. Speck (mechanical), Forrest B. Adams (electrical)
Interior:
Mark Hampton, Inc.
Kitchen:
HRI, Inc.
Acoustics:
Variable Acoustics, Inc.
General contractor:
JBM Builders, Inc.

Wachusett Mountain Base Lodge
Princeton, Massachusetts
Lindsay Shives & Associates, Inc., Architects

A ski lodge for all seasons

As far as its managers can discover, Wachusett Mountain lodge is the first ski facility in the country to take its summertime business as seriously as its wintertime business. Wachusett Mountain, the second highest mountain in Massachusetts, had for some years functioned as a modest "neighborhood" ski area. But the commonwealth, which owns the mountain as part of its state park system, concluded after a 10-year study that the ski area could be expanded. (Because of the countryside's fragility, however, the park system limits traffic, both downhill and cross-country, to 2,000 skiers at a time.) The firm selected in competition to develop the ski area (it used to run the old T-bar tow) determined to find year-round use for the facility.

This decision obliged architect Lindsay Shives, designing the base lodge, to consider two sets of users, the two having far different purposes and personalities. On the one hand, skiers hurry to get on the slopes, spending as little time as possible on such nonskiing essentials as food. To accommodate both haste and essentials, Shives directed circulation along a linear sequence from parking to chairlifts. Skiers who need only lift tickets buy these at an exterior box office at one end of the lodge and then proceed on a covered exterior corridor to the lift area. Other skiers may enter the parallel interior corridor to reach, in order, instruction registration, a rental/retail shop, and a cafeteria. As the mood strikes them, they can peel off to the exterior corridor. Optionally, the wide, wood-floored interior corridor becomes a mall, with a shop window on one side and a view of the pond on the other.

In warm weather, on the other hand, and especially in the New England autumn, the lodge draws quite another group—two groups, actually: active backpackers and simple strollers. During these seasons, the dining room, which in ski season offers buffets to families, becomes a conventional restaurant. More important to the operators, other spaces convert to other uses: the ski schoolroom becomes an art gallery and conference room, the outdoor decks become entertainment space. The staff reports with pleasure that the facility has attracted both business groups and wedding parties.

In addition to the linear circulation pattern, the constricted site itself helped to force the building's plan. A retention pond in front, which provides water for snowmaking, is bounded by a road on one side. At the back of the site, the mountain leaves minimal space for the lift area, which in any case must be close to the lodge—practice recommends that skiers walk no more than 150 feet from lodge to lift.

The $8-million development budget allowed $1.2 million for the 23,000-square-foot lodge. The rest of the money went for new trails, three chairlifts, snowmaking equipment and utilities. *Grace Anderson*
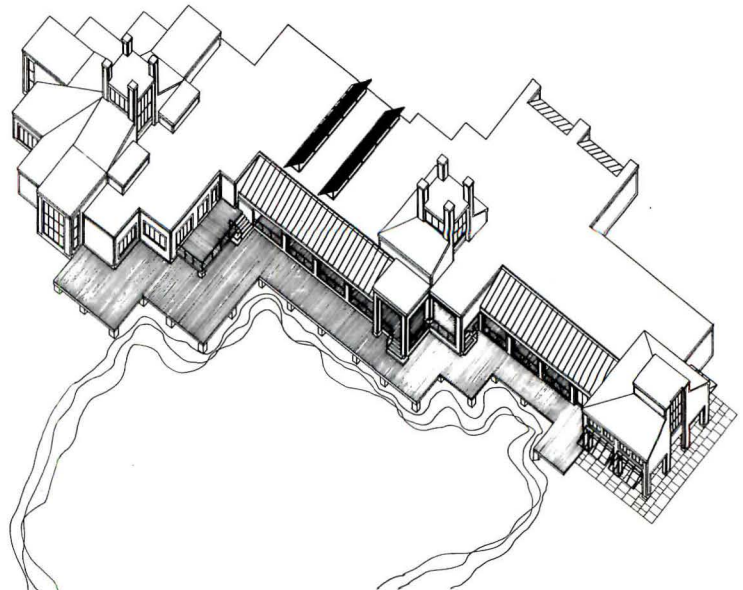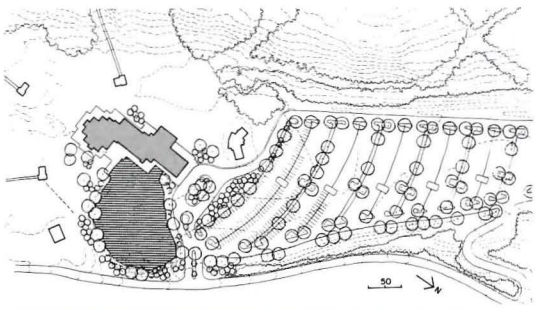
The stained clapboard that faces the ski lodge befits its purpose and the comfortable central Massachusetts architecture in the neighborhood, while the dark orange corner boards and tower trim give it what architect Shives calls "a sense of destination," perceived by visitors arriving by road as well as by skiers descending the slopes. The clapboard and orange corner boards are carried indoors as basic ornamental motifs. (Though users seldom count aroma as an architectural element, the evocative smell of cedar walls here imparts a distinctly lodgelike character to vestibule and corridor.) Since skiers are already warmly dressed, an outdoor corridor (across page, bottom left) is doubtless more comfortable than a heated room; in summer, the deck becomes a shaded verandah.

The interior of Wachusett Mountain lodge has the relaxed woodsy air commonly associated with aprés ski activity, its clapboard siding borrowed from the exterior and its laminated wood post-and-beam structure exposed to view. The dining room (opposite) is shown set up as a summer restaurant. A small conversation pit (below), set below a tower monitor, occupies a railed platform at halfway level between bar and dining room (the railings can be seen between dining room columns). The conservation of energy in the wintertime facility takes many forms, most notably in the recycling of heat from compressors for snowmaking (heat diagram at bottom, opposite). Architect Shives reports that the operators initially intended to hide the compressors in a building well removed from the lodge because of excessive heat. The mere mention of heat elicited automatic architectural reaction and thoughts of heat recovery; the compressor facility consequently was made an integral part of the lodge. The use of solar heat shaped the dining pavilion, where large windows receive abundant southern light in winter. An active solar collector provides domestic hot water.

1. Dining
2. Lounge
3. Serving
4. Kitchen
5. Kitchen storage
6. Hearth room
7. Retail/rental
8. Ski school/gallery
9. Manager
10. Information desk
11. Tickets
12. Snowmaking
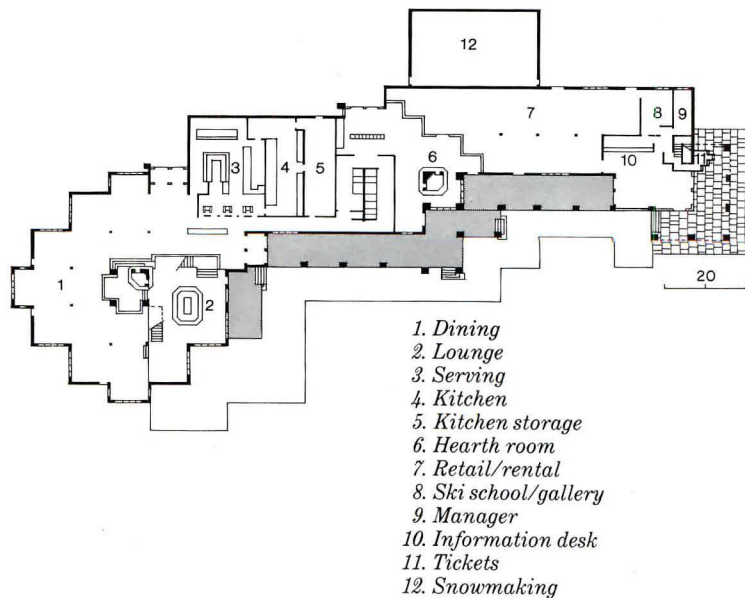
Wachusett Mountain Base Lodge
Princeton, Massachusetts
Owner:
Wachusett Mountain Associates,
Inc.
Architects:
Lindsay Shives & Associates, Inc.—
Lindsay Shives, AIA, project
architect; Douglas Cole Smith, FAIA,
project associate; Douglas Manley,
project manager

Engineers:
Bolton & DiMartino, Inc.
(structural); R. G. Vanderweil
(mechanical/electrical/plumbing);
Alford International, Inc.
(mountain utilities/snowmaking)
Consultants:
Sno-Engineering, Inc./Resource
Development (mountain planners);
Greenscape (landscape)
General contractor:
R. H. White Construction Co., Inc.
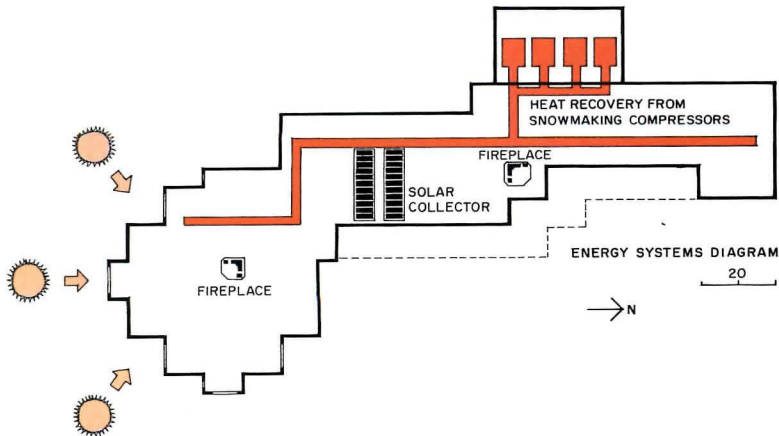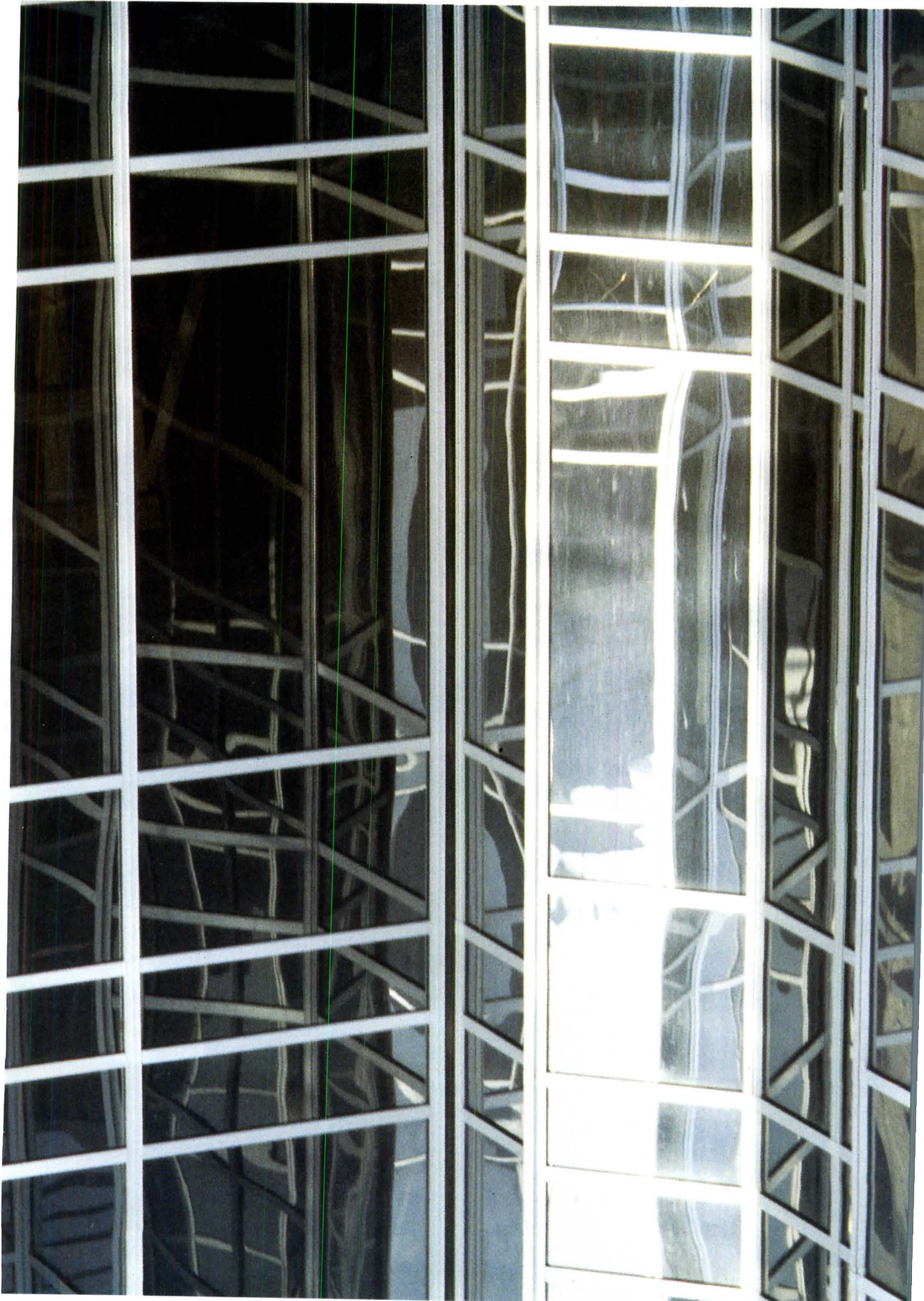
HEAT RECOVERY FROM
SNOWMAKING COMPRESSORS

FIREPLACE

SOLAR
COLLECTOR

FIREPLACE

ENERGY SYSTEMS DIAGRAM

20

N

Reflections on a curtain wall

Though it seems reasonable that PPG would require that their headquarters be a statement of their product, the corporation, in fact, put no such requisites on design. Not surprisingly, however, the architects, John Burgee and Philip Johnson, thought in terms of a glass tower from the onset. The site designated for construction was comprised of 5.5 acres in Pittsburgh's Triangle.

And neither did the clients demand that their project fully occupy the site; the architects advocated developing the entire site with a six-building composition. Of the six buildings, four are six stories, one is 14 stories, and the PPG Tower is 40 stories. The buildings provide 1.5 million sq ft of office, and 70,000 sq ft of retail space. The primary tenant, PPG Industries, occupies the upper two-thirds of the Tower.

Two features of PPG Place make it memorable:

The first is the organization of space around and between the six buildings comprising the complex. Here, vehicular and pedestrian movement has been engineered with a connective tissue that knits the existing urban fabric into a logical and inviting network, culminating at a plaza—a dazzling space of reflected light that is punctuated by a granite obelisk. From an urban design standpoint, one feels the exigencies of the city, not the building, had the upper (and wiser) hand in the site design. Architectural historian K. B. S. Toker has acclaimed PPG Place as "one of the most ambitious, sensitive and public-spirited urban developments since Rockefeller Center."

The second feature that makes this project a rare delight is, of course, the virtuoso use of reflective glass. Certainly, there is nothing new about the material; it has been on the market since the mid-1960s. What makes this application special is the pleating of the curtain wall into a sequence of facets which seem to pick up speed and energy at the four corners. (These corners have a crystalline silhouette that, in plan, recalls the wall geometry of Renaissance military fortifications such as those proposed by Michaelangelo.) Because the glass reflects, this faceting speaks to itself. And because the buildings form an enclosure, adjacent and opposing walls send light back and forth surrounding the pedestrian with what might be a first—a mirrored courtyard.

Sunlight puts the wall surfaces in motion. In an ever-changing pattern from sunrise to sunset, season to season, the buildings take on a spectrum of qualities that vary from dense mass to transparent veils, from shimmers to sparkles to undulent swirls. The silver-colored aluminum mullions contrast in texture with the glass, heightening the visual effect of reflection, and hatching together the mercurial surfaces. In arriving at the curtain wall's design, the architects supplemented drawing with a variety of three-dimensional modeling

Engineering

1. *PPG Tower*
2. *Winter garden*
3. *Fourteen-story office and retail facility*
4. *Six-story office and retail facility*
5. *Plaza with obelisk*

GROUND FLOOR
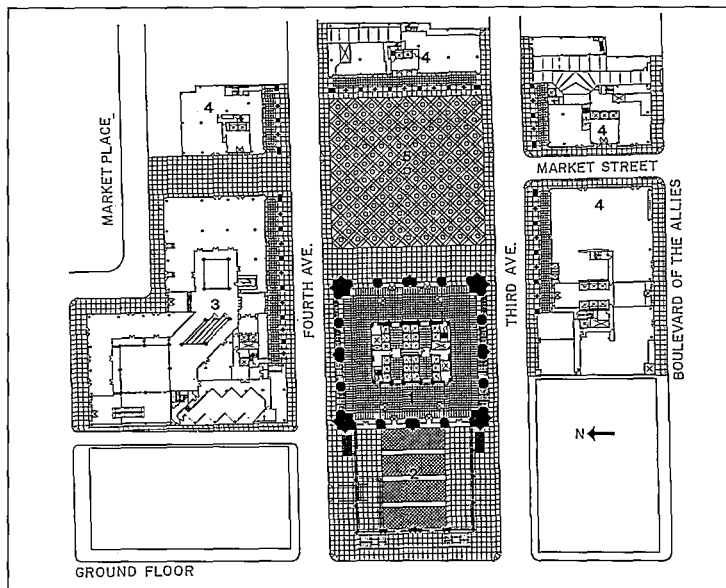
Like other reflective glass curtain-wall buildings, PPG Place visually responds to the varying ambient light of dawn, dusk, night, and full sun. Unlike other glass towers, PPG's "pleats" significantly extend its vocabulary of surface effects. At times, the Tower's monolithic form on the urban skyline is turned into a bundle of delicate, radiant shafts.

techniques. After working out the preliminary design on paper, a six-foot model of the complex was made using the specified PPG glass products. This model was used to study the massing and evaluate the qualities rendered by the skin's neutral silver reflective glass. Following its making, a full-scale, three-story-high mock-up was constructed at PPG's Ford City, Pennsylvania plant. The mock-up gave the architects and client an opportunity to study the esthetic character of the wall in greater detail. (It also gave the construction team an opportunity to experiment with assembly procedures.) Dark mullions had been used in the mock-up. Dissatisfied with these, the architects reversed their earlier decision, and designated a clear anodized aluminum mullion that better emphasized the pleating and reflected more light onto the wall.

Model-making played an indispensable part in developing shop drawings for mullions. In all, 175 different dies were necessary for the curtain wall's goemetry—a formidable exercise in custom design. The most complex mullion details occur at the base and top of buildings. Here, the pleats resolve themselves into the "neo-Gothic" pointed openings in the esplanade, and the 234 spires that crown the six buildings. The architectural intention was to have vertical mullions grow from the ground in an uninterrupted line. In order to accomplish this, lines had to bend and converge. The geometry involved in these intersections was extremely difficult to envision. As an aid, a project architect, Glenn Garrison, studied lines in the masonry details at St. Patrick's Cathedral in New York. Still, it was impossible to understand and describe on paper many of the curtain wall's profiles. Therefore, the architects and the fabricators built models of these mullion joints that bring together glass converging from more than one plane. The extreme example of the multi-planar geometry is at the peak of esplanade openings. Here, eight difficult angles in space converge at one point. With models of this and other details in hand, shop drawings for the curtain wall could be completed: 50 sheets for the typical office floors; 100 sheets for the base and crown of the buildings.

When the look of the wall was fully resolved in design terms, the performance of the wall was tested. Here again, models were used. First, the entire system was analyzed by independent consultants at Colorado State University. Their tests included a mathematic investigation with computer simulation techniques, and wind tunnel testing on a sealed replica of the complex. Later, another battery of tests was conducted on the design at the Construction Research Laboratories in Miami, Florida. Again, wind tunnel tests were performed, this time on a model built at 1:400 scale, to determine the

At close range, the curtain wall's cameleon-like character displays a rich array of surface qualities, intensified by self-reflection. Not only do separate buildings mirror each other, parts of individual buildings reflect themselves. For example, corners are doubly spliced with aluminum mullions and their reflections (right).

flow pattern of wind across the building surface. Then a full mock-up of a 38- by 38-ft typical wall section was tested for air and water infiltration and structural integrity. Infiltration was tested dynamically with a 2100-hp wind generator and a spray rack. A partial vacuum was pulled in the test chamber to determine whether the spray was able to penetrate the wall system. All seals and weep details performed according to design. Structural integrity was tested by pressurizing and evacuating the test chamber. All components tested at 150 per cent of their design load.

Construction of the buildings' steel columns and reinforced concrete floor slabs preceded in four-story intervals. Installation of the curtain wall with its nearly one million square feet of glass sheathing followed right behind in two, two-story jumps. To the project's advantage, PPG's Commercial Construction Group hung the curtain wall. With client and contractor one-and-the-same, there was a tremendous incentive on the part of tradesmen and management for a perfect installation. Not only did everything go smoothly on site, since completion, no defects in the curtain wall have emerged.

The completed buildings have been evaluated for thermal performance. Design standards for energy consumption were set by the architects as part of the initial programming. The reflective and thermal characteristics of the glass materials selected for the curtain was to play a large part in realizing that standard. The buildings are using approximately 40,000 Btus per square foot per year, compared to 129,000 in PPG's former headquarters—a two-thirds reduction in energy consumption.

This truly unique curtain wall is the result of an extraordinary effort in design, and testing, as well as fabrication, and installation. Together with the cost of materials, these factors add up to the building's rather extraordinary price tag with respect to other commercial developments. The question that inevitably arises is, does the final result justify the effort and expenditure? PPG, the architects, and most Pittsburgh natives think it does. In conjunction with the site plan and massing, this unique and surprisingly friendly curtain wall raises the project above what it might have been in the hands of a lesser architect and client: the all-too familiar, acceptable, but uninspired box. As a corporate headquarters, PPG Place stands out as a convincing advertisement for the technical and esthetic potential the client's products offer. Corporate pride aside, PPG Place is more importantly the focus of considerable civic pride, a remarkable tribute to a project that owes much of its success to the materials and the details of its construction. Something to reflect on. . . . *D.R.*

3"
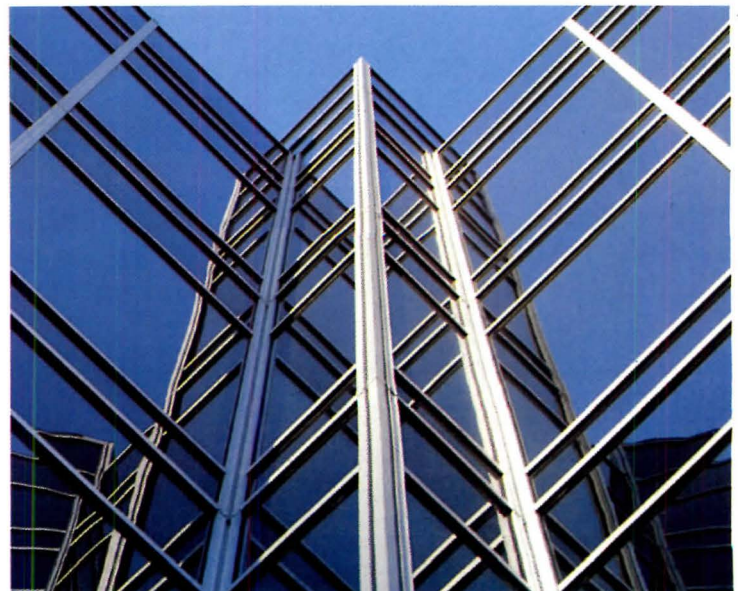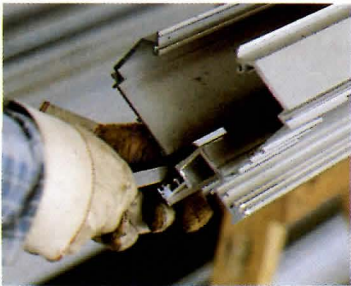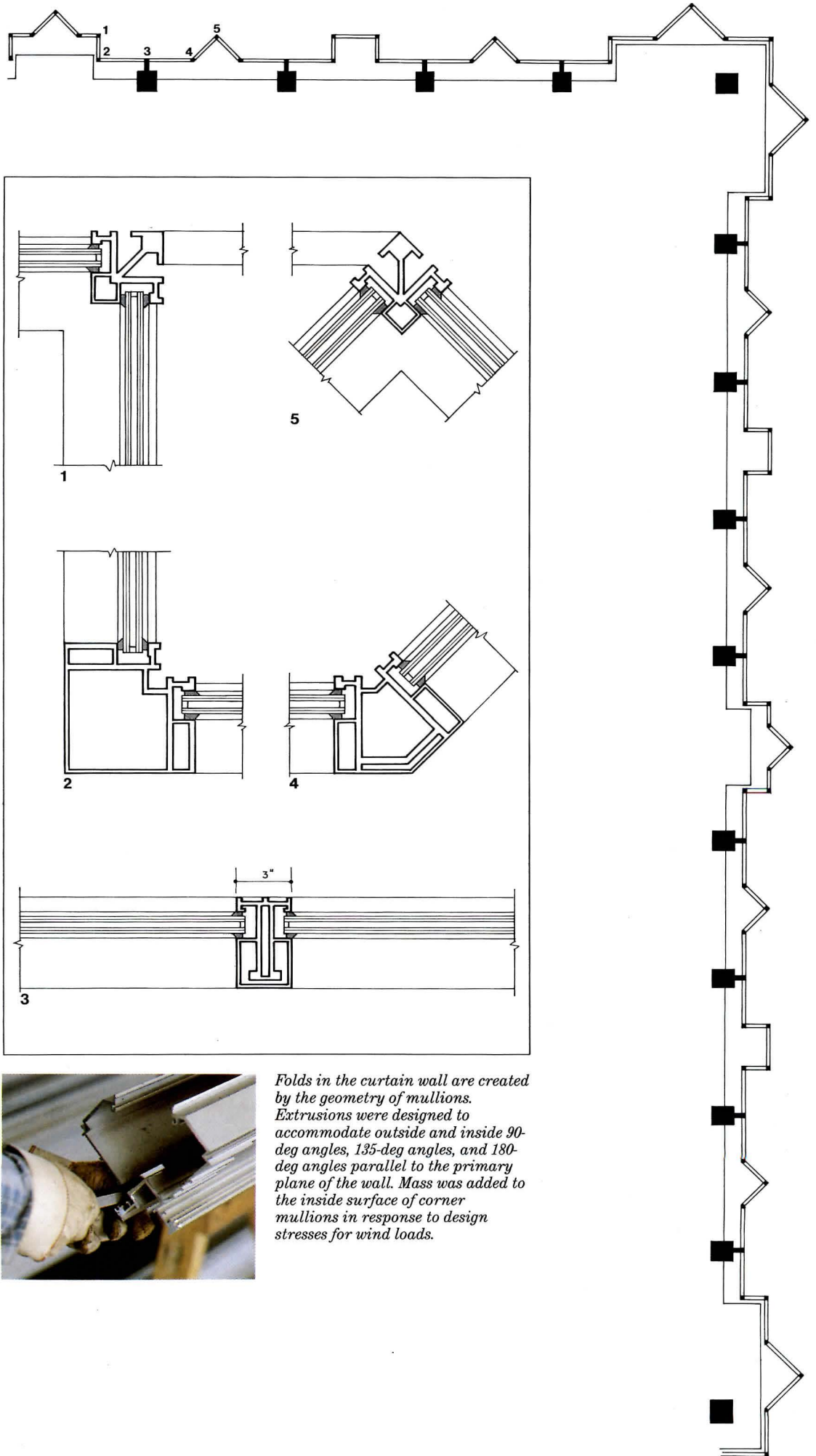
Folds in the curtain wall are created by the geometry of mullions. Extrusions were designed to accommodate outside and inside 90-deg angles, 135-deg angles, and 180-deg angles parallel to the primary plane of the wall. Mass was added to the inside surface of corner mullions in response to design stresses for wind loads.
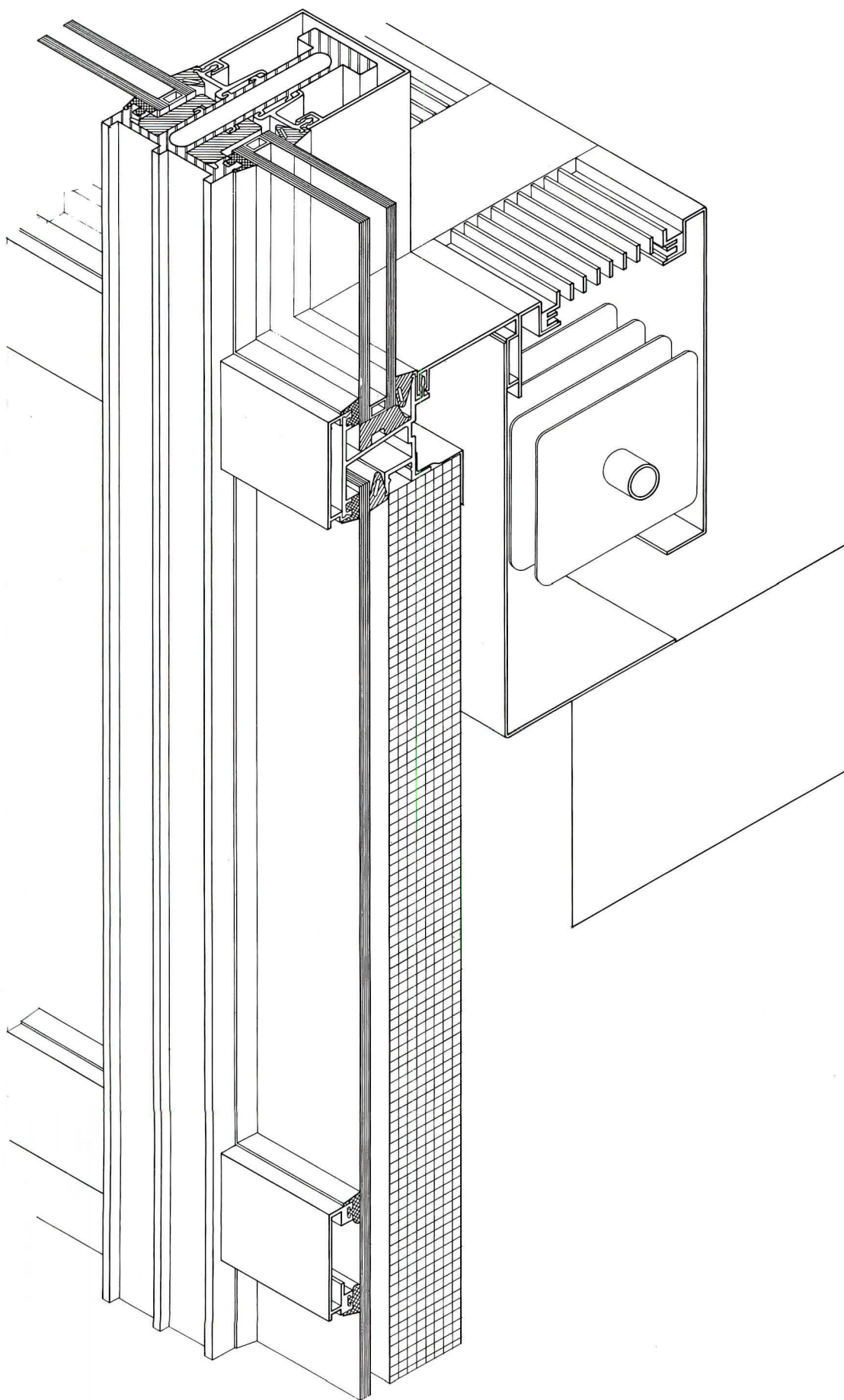
The architects, John Burgee and Associates with Philip Johnson, had total control over the "look" of the curtain wall. PPG's role as manufacturer, fabricator, and installer was to make the design work in glass and aluminum. All the elements comprising the curtain wall were chosen or custom-designed to meet the esthetic and performance criteria set by the architects.

Glass was made in Crystal City, Missouri and shipped to Pennsylvania where it was coated and fabricated into insulating panels at PPG's Ford City plant. The 175 mullion profiles required to shape the curtain wall's geometry were extruded in a silver-colored aluminum in Terrell, Texas and shipped to the construction site. For the sake of erection, vertical mullions were manufactured in two-story lengths.

The installation of the curtain wall followed a four-story-at-a-time sequence of construction for the structural steel columns and reinforced concrete slabs that comprise the buildings's primary structure. In installing the curtain wall, anchors were attached to plates at the end of floor slabs. The plates, occurring at the position of every vertical mullion, were typically secured in the slab with a 2 ft steel rod—never was the curtain wall permitted to tie directly into the building's structure steel. To these plates was fixed an anchor; to the anchor, the two-story verticals. Horizontal mullions were then installed, completing the frame for the glass panels. Before the glass was installed, a soft neoprene gasket was placed in the frame that ran the length of the four sides. Vulcanized rubber L's were used at the corners to complete the inner framework. The glass itself was
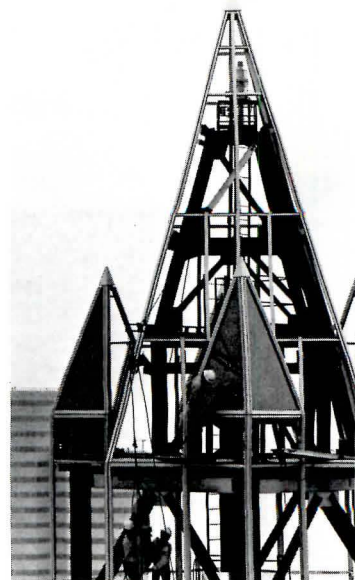
lowered and tilted into the frame from the inboard side, according to the glazing pocket design. A glazing bead was then applied, followed by the driving of a vulcanized wedge around the inside of the frame—the wedge pushes against the softer neoprene gasket, thus setting the air seal. Finally, all interior details were trimmed out.

The esplanade and spire levels of the curtain wall was considerably more difficult to install than typical office floors. First, mitre cuts were made *in situ* on the extrusions to form the spires and the frame around pointed openings and parapet towers. Depending on the installer's ability to maneuver around steel supports and fit trapezoidal and triangular panels into their pockets, the glass here was sometimes in-filled from the outboard side.

The curtain wall incorporated three glass products: a clear, reflective coated, double-glazed vision glass; reflective spandrel units, backed with fiberglass and a foil vapor barrier, used at the spandrel zones and mechanical floors; and a clear, doubled-glazed panel used in the Wintergarden and the retail storefronts.

The most promising design on paper can lead to a disappointing building if the crafting of the design doesn't provide a just follow-through. Happily, the construction of PPG Place is of the highest caliber. Though the architect is typically a major advocate of quality on the construction site (often to the consternation of the contractor) at PPG Place the installers, being one-and-the-same as the client, were highly self-motivated to work out unusual procedures for erection and maintain a superior level of craft throughout.

PPG Place
Pittsburgh, Pennsylvania
Owner:
PPG Industries
Architects:
John Burgee Architects with Philip Johnson, New York City— Glenn Garrison, associate; Anne Asher, project architect; James Martin; field representative
General consultants:
Robertson, Fowler & Associates, structural; Cosentini Associates, mechanical; W.A. DiGiacomo & Associates, electrical; Claude R. Engle, lighting; Calvin Kort, elevators; Edison Parking, parking; Cerami & Associates, acoustical; Vignelli Associates, graphics; Cope Linder Associates, retail; Zion & Breen, landscape
Curtain wall design and consulting:
Curtain Wall Design and Consulting, Inc., Dallas, Texas, and PPG Industries Commercial Construction Group
Curtain wall mullions and transoms:
Howmet Aluminium Corp., Terrell, Texas and PPG Industries
Curtain wall installation:
Commercial Construction Group, PPG's Industries Commercial Construction Group
Development manager:
Tishman Realty & Construction Company of Pennsylvania
General contractor:
Mellon-Stuart/Blount

2-22
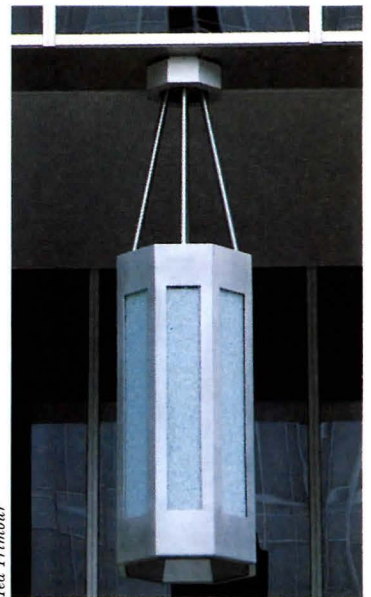
Ted Trimbur

Ted Trimbur

Axonometric of curtain wall detail (opposite page, far left), indicating the position of a non-structural mullion (lower left in drawing) placed for graphic effect, on the insulated spandrel glass.
The sequence of glass installation in PPG's Tower's corner spires is shown in three photos at left. Each panel was hoisted into position and fixed to the aluminum frame. Typically, glass was installed from the inside, however, the trapozoidal and triangular geometry of the spire panels required an exterior installation.

To continue their essay in glass beyond the curtain wall, the architects used ornamental glass finishes in the Tower elevator lobby. Photograph at top shows brandied crimson spandrel glass set in diamond pattern and finished with light gray silicon calk. The crimson color was specially developed for the project. Laminated "mirror" glass panels were used in elevator cabs (above left). Similar in surface to the glass used in elevators, the panels used for the lanterns that circle the plaza arcade consist of two sheets of clear glass in an insulating unit with the air space filled with fragments of shattered tempered glass (right above).

New products

For more information, circle
item numbers on Reader Service
Card, pages 283-284

1

2

Harry Orner

3

4

Convertible lounge chair
The *ChairBed* is a recent
introduction by Adden, a
manufacturer of dormitory
furniture. Part of a new collection
of furnishings designed for medical
institutions, the *ChairBed* was
developed to assist health care
facilities in accommodating a
patient's visiting family members.
In an upright position (1) it is a
rocking/swivel chair. Unfolded (2) it
becomes a 21-in.-wide and 76-in.-
long bed. The hardwood internal
frame is double-dowel constructed
and supports cushions wrapped in
high-resiliency dacron. The chair is
available in either fabric or vinyl
upholstery, with solid oak armrests.
Other components of the health-
care line include oak

headboards/footboards for patient
beds, patient chairs with or without
footrests, desks, wardrobes,
nightstands, and waiting or
reception area seating. Adden
Furniture, Lowell, Mass.
Circle 300 on reader service card
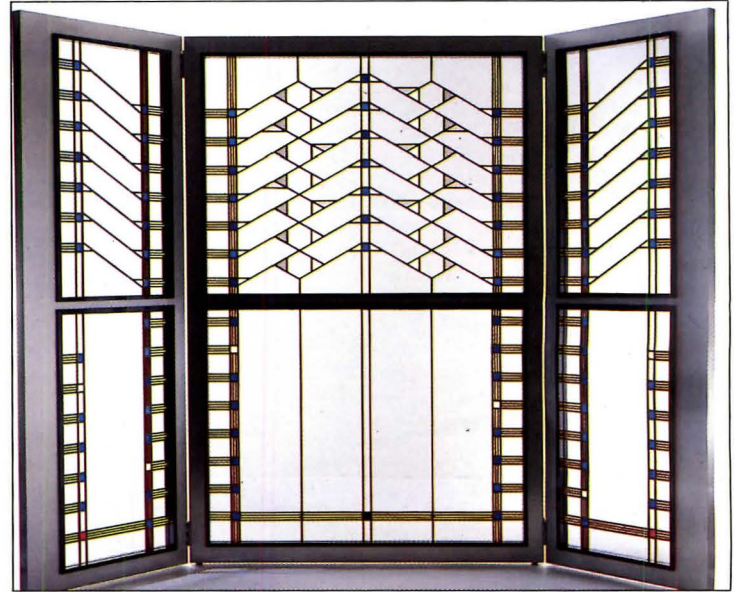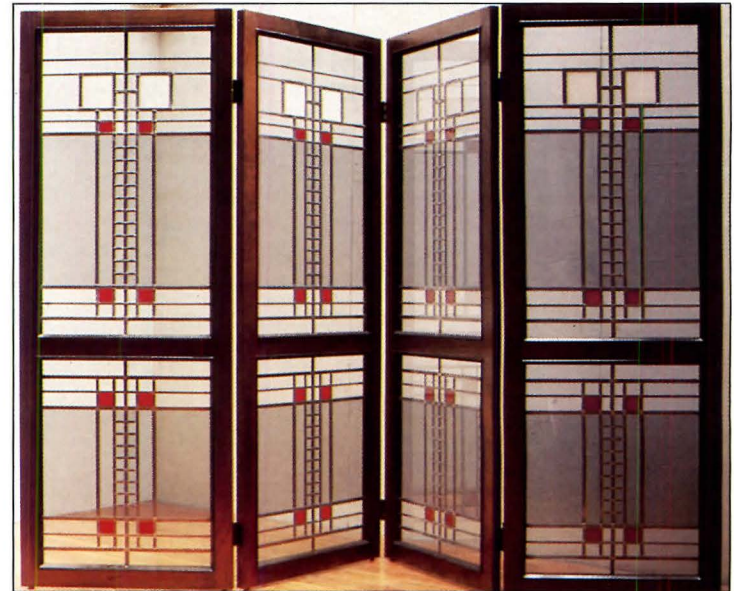
Reflections of the "Wright Way"
The folding glass screens designed
and constructed by Californian
Arthur Stern reflect a studied
interest in the work of several
modernist masters. Clearly inspired
by the glass work in many of Frank
Lloyd Wright's Prairie Houses, the
panels are intended to detail
"volumetric progressions, rhythms,
and proportions" present in the
surrounding architecture, according
to the artist. Stern's version of the
"Wright Way," which emphasizes
glass design as one aspect of a
totally designed environment, also
refers to another modernist
heavyweight—Le Corbusier;
Stern's stated adage, "Geometry is
the language of architecture," is a
compromise of Le Corbusier's claim
that "Geometry is the language of
man." Stern uses the regulating
lines of geometry as his method, or
vocabulary, of glass design. He

"composes" progressions and
rhythms through the repetition and
variation of shapes, patterns, and
colors. *Frozen Music/Opus 23* (3)
and *Frozen Music Quartet* (4), for
example, are made from handblown
and graylite plate glass, framed in
lacquered wood. *Opus* is 8 ft wide
and 6 1/2 ft high and *Quartet* is
approximately 5 ft square. Both
feature simple, repetitive patterns,
accented with pieces of leaded
glass. Although their suspended
state may not prove to be timeless,
as the analogy to music implies,
their concerns with geometry and
the language of architecture may
prove to be. Architectural Glass,
Arthur Stern Studios,
Oakland, Calif.
Circle 301 on reader service card
More products on page 213

New products *continued*

Instructional CAD system
ProEd is a turnkey CAD learning system that combines video class lectures with practice laboratory exercises. The system consists of a 6.7-megabyte hard disk, a 15-in. raster display screen, an A-B size plotter, a set of 38 lessons (equal to 12 hours of instruction) on videotape, and instructor and student manuals. The student can test his or her own fluency with a software package through drawing exercises provided in the manuals. Additional system options include dual 19-in. monochromatic/color displays, dual 15-in. monochromatic displays, a C-D size plotter, a line printer, a 27-megabyte hard disk, and more advanced software packages. Bausch & Lomb Interactive Graphics, Austin, Tex.
Circle 302 on reader service card

Drafting system
The *GEOCAD* turnkey system is a low-cost architect-designed drafting program that is constantly tested and upgraded through its use in an architectural firm. The 16-bit *APC* microcomputer, offered as part of the system by special arrangement with NEC Information Systems, comes configured with 384K of RAM, expandable to 512K. The screen can display up to eight colors with a resolution of 640 by 275 pixels. The detachable keyboard has 44 programmable keys. A one-megabyte floppy disk and a hard disk sub-system, with a storage capacity of 10 megabytes, accommodate mass storage. Rudolph Horowitz Associates, Architects, Pound Ridge, N. Y.
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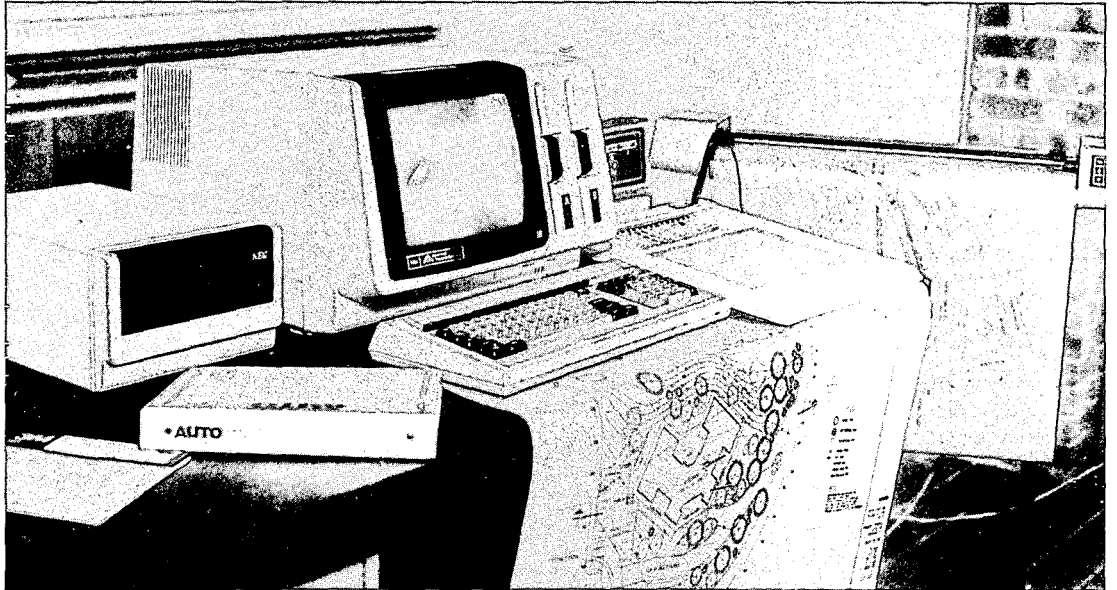
CAD software
Steel 3-D is a graphic design and analysis program for two- and three-dimensional steel frame structures. The completely integrated software package includes functions for building and editing a structural model, applying loads and properties, performing static analyses, displaying shear and moment diagrams, and checking the structure's compliance with AISC or other user-defined codes. The system features on-screen menus and prompt buttons located alongside the screen. Portions of a three-dimensional model can be rotated, isolated, zoomed in on, or highlighted in color to permit a detailed examination of a problem area. Auto-trol Technology, Denver.
Circle 304 on reader service card
More products on page 213
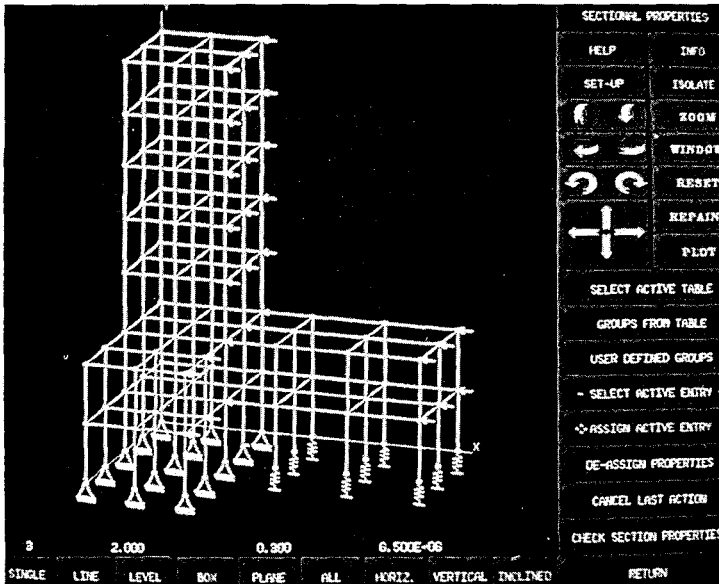
"I insist on SILGLAZE®N silicone sealant for my skylights."

Harold Gelvan, President
Horizon Skylight Systems, Inc.
Paterson, New Jersey
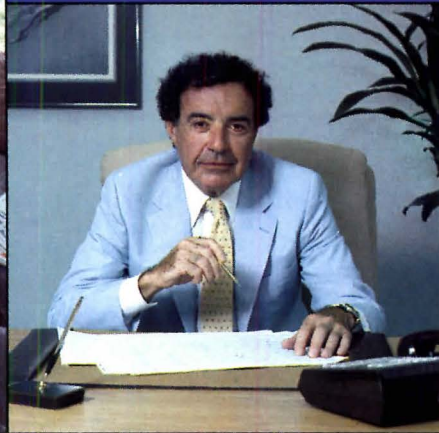
When it comes to skylights, the sealant is a big part of the picture. Just ask Harold Gelvan, whose company is a leading manufacturer of standard and custom skylights.

"We believe in using the highest quality grade materials for all components of our skylights—glass, aluminum and sealant," says Gelvan. *"SILGLAZE N silicone sealant from General Electric Silicones is top of the line. We use it in all our windows, we recommend it to the installers, and we even package it right with each unit we send out."*

It's no surprise. Advanced technology SILGLAZE N sealant has become the material of choice for a wide variety of demanding glazing applications. SILGLAZE N sealant offers primerless adhesion to substrates like glass and aluminum...an optimum tooling time of six to nine minutes...a ± 50% joint movement capability...and translucency that blends with any color substrate. In fact, it's the only translucent, low modulus, neutral cure silicone glazing sealant on the market today.

Give SILGLAZE N translucent sealant your glazing challenge. For more information on this high-performance material and the full line of construction sealants from GE Silicones, circle the number below, or call (518) 266-2315.
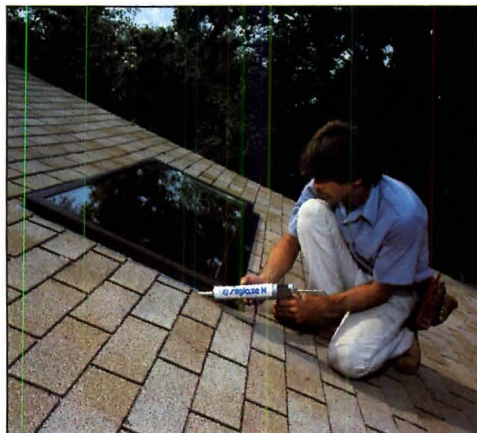
silglaze® N
SILICONE
2501 SEALANT

Product literature

For more information, circle
item numbers on Reader Service
Card, pages 283-284
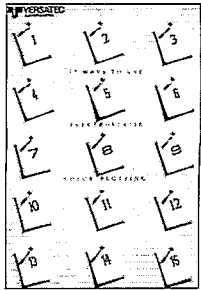
Electrostatic color plotting
Fifteen basic applications of electrostatic color plotting are described in a 12-page color brochure. The device is capable of producing plots as complex as 15 million vectors, in formats up to 40 in. by 500 ft, in a range of 512 colors, and at a speed of 1 in. per second. Versatec, Santa Clara, Calif.
Circle 400 on reader service card

Microcomputer interfacing
An 18-page booklet introduces *Micro-Match*, a system for interfacing microcomputers to peripherals and other computers. The literature includes examples of device-to-device connections and samples of research reports. Command Computer Corp., Philadelphia.
Circle 401 on reader service card
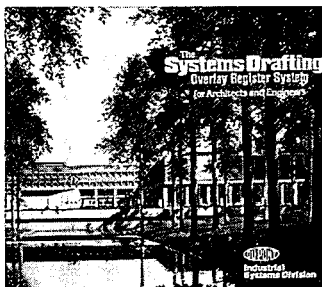
Overlay drafting
The *Overlay Register System*, which uses a series of overlay drawings to produce a composite, is featured in a 4-page color brochure. The workings of the system, described as an intermediate step in a move towards CAD, are described in the literature. DuPont, Wilmington, Del.
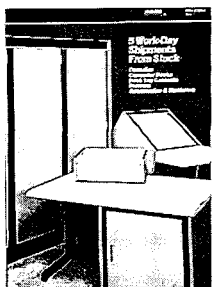*Circle 402 on reader service card*
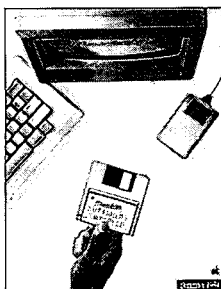
Software
A 28-page color brochure shows a sample of available *Macintosh* software packages. Included are descriptions of *MacDraw*, which permits freehand drawing and creation of a library of symbols, and the *DaVinci* series, libraries of professionally drawn landscapes, buildings, and interiors. Apple Computer Inc., Cupertino, Calif.
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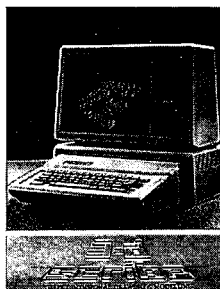
Computer support furniture
A 36-page color catalog contains photos and descriptions of computer consoles and desks, desktop cabinets, blowers, accessories, and hardware. Diagrams showing the features and dimensions of each product are included. Amco Engineering Co., Schiller Park, Ill.
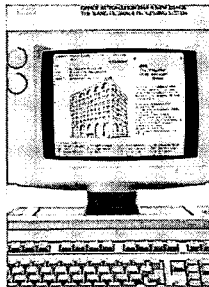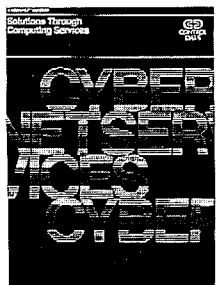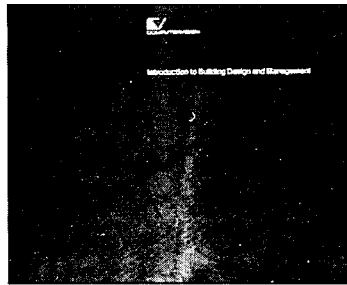*Circle 404 on reader service card*

Computer resource service
Cybernet, a computer resource service that operates through time-sharing data centers with distributed processing to in-house microcomputers, is outlined in a 30-page color brochure. Information on gaining access to the service, by a telephone-line hook-up, is included in the literature. Control Data, Minneapolis.
Circle 405 on reader service card

Power conditioners
A 20-page illustrated brochure describes an expanded line of power conditioners designed to protect electronic equipment from voltage irregularities. The manufacturer's new rack-mount regulator, several computer power center models, and power line monitors are shown. Sola Electric, Div. of General Signal, Elk Grove Village, Ill.
Circle 406 on reader service card

CAD system
PC-800 Model 3 is shown in a 12-page brochure. This task-oriented turnkey CAD system uses command buttons and function keys for on-screen graphic manipulations. The system includes a high-resolution photo plotter. The Gerber Scientific Instrument Co., South Windsor, Conn.,
Circle 407 on reader service card

CAE system
A 10-page color brochure describes *CAEMIS*, a computer-aided engineering and management information services system, with interactive 3-D graphics, engineering analysis, and database management. The turnkey system includes DEC VAX-11-780 hardware. Impell Corp., San Francisco.
Circle 408 on reader service card

CAD program
Scribe, a microcomputer system for the modeling and evaluation of building designs, is featured in a 4-page color brochure. Sections on drawing and input methods, and perspective, projection, output, and printing abilities are included in the literature. 3-D Scribe International, Santa Ana, Calif.
Circle 409 on reader service card

Image processing
A 24-page color brochure outlines the *PIC* processing system, which can capture images through an image scanner and then edit and communicate them. The system can be used to scan incoming mail or insert, lighten, darken, and position images within blocks of text. Wang Laboratories, Inc., Lowell, Mass.
Circle 410 on reader service card

CAD/CAM system
The components of a CAD/CAM system are shown in a 28-page brochure. Diagrams of workstations, the database, user interface, key-file menus, and library elements are included. 3-D visualization capabilities are featured. Computervision Corp., Bedford, Mass.
Circle 411 on reader service card
More literature on page 211

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Metz, Train and Youngren, Architects.

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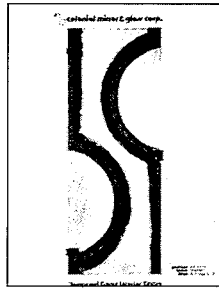
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(517) 263-8881

The Wrigley Building, Chicago, IL
Dr. Stephen Carr, Dept. of Materials Science and
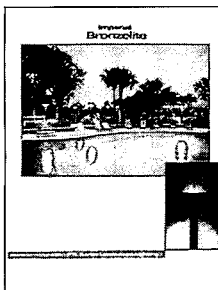Engineering, Northwestern University, Consultant.

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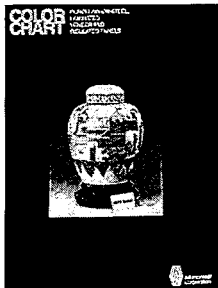
Porcelain enamel coating
A 4-page brochure includes a revised color chart of the manufacturer's line of porcelain enamel coatings. A brief description of the product, which can be fused to steel or aluminum, and suggested cleaning methods accompany the samples of semi-gloss and matte finishes. AllianceWall Corp., Atlanta.
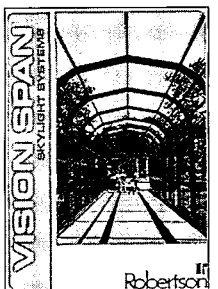*Circle 412 on reader service card*

Landscape lighting
The *PTL* series of pole-mounted landscape lighting fixtures for incandescent and mercury vapor light sources is featured in a 6-page color brochure. Specifications, options, photometric data, and ordering information for the product line are included in the literature. Imperial Bronzelite, San Marcos, Tex.
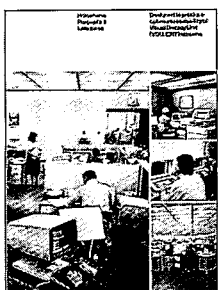*Circle 413 on reader service card*

Skylight system
A 12-page color brochure contains photos of skylights and glass-covered atriums and walkways. Diagrams show lean-to, elbow, multiple pyramid, ridge, dome, and barrel vault construction details. A design load chart is also included. H. H. Robertson Co., Pittsburgh.
Circle 414 on reader service card

Fluorescent luminaires
Percepta fluorescent luminaires, designed to reduce glare on computer terminal screens, are featured in a 4-page color brochure. Details on the prismatic optical system and its twin-beam method of light distribution are provided. Dimensions and specifications are included. Manville, Denver.
Circle 415 on reader service card

Roofing membrane
An 8-page color brochure features the *RubberGard* EPDM commercial roofing membrane. Photos of several applications, drawings of the attachment method, and a list of the product's physical properties are included in the literature. Firestone Industrial Products Co., Indianapolis.
Circle 416 on reader service card

Laminated wood flooring
Prefinished laminated wood flooring is featured in an 8-page color brochure. The manufacturer's special "floating" system, which positions the hardwood planks above the subfloor, is described. Photos of basic patterns and their specifications are included. Harris-Tarkett, Johnson City, Tenn.
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Interior glass doors
Tempered glass interior doors, said to be five times stronger than standard glass doors, are illustrated in a 4-page color catalog. Eleven types of glass and a selection of the 23 available colors are shown. Photos of locksets and hinges are included. Colonial Mirror & Glass Corp., Brooklyn, N. Y.
Circle 418 on reader service card

Fireplace
An 8-page color brochure features *Heatform* masonry fireplaces. Different models of the fireplace, which is designed to be heat-circulating and energy-saving, are shown. Heat-flow diagrams, installation information, and a performance comparison graph are included in the literature. Superior Fireplace Co., Fullerton, Calif.
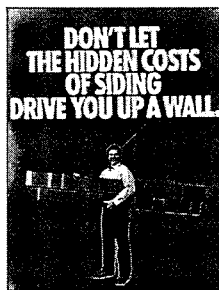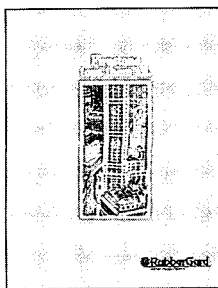*Circle 419 on reader service card*

Partition system
The *GB-350* gravity lock demountable partition system is featured in a 16-page brochure. Descriptions of partition height limitations, fire ratings, and accessories are included in the literature. Diagrams reveal standard track and panel construction. Gold Bond Building Products, Charlotte, N. C.
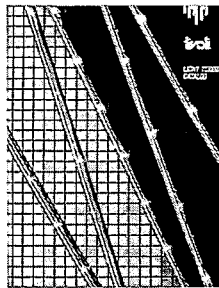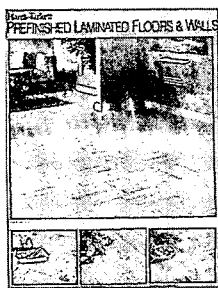*Circle 420 on reader service card*

Siding materials
The cost considerations of such siding materials as plywood, hardboard, and lap sidings are reviewed in a 4-page color brochure. The literature emphasizes the affordability and benefits of the manufacturer's 8-ft cedar siding panels. Shakertown Corp., Winlock, Wash.
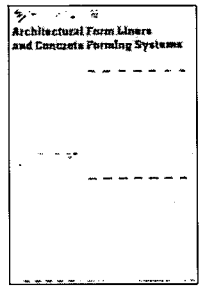*Circle 421 on reader service card*

Light tubing
A 40-page color catalog features the manufacturer's line of low-voltage light tubing. Each of the five lamp spacings—2 in., 3 in., 4 in., 6 in., and 12 in.—are shown in both interior and exterior settings. Optional lighting controllers are reviewed. Tivoli Industries, Santa Ana, Calif.
Circle 422 on reader service card

Form liners
The manufacturer's line of architectural form liners is described in a 16-page color brochure. Sections on form liner designs, specifications, and accessories are included in the literature. Each of 50 standard patterns and textures is illustrated. Symons Corp., Des Plaines, Ill.
*Circle 423 on reader service card*
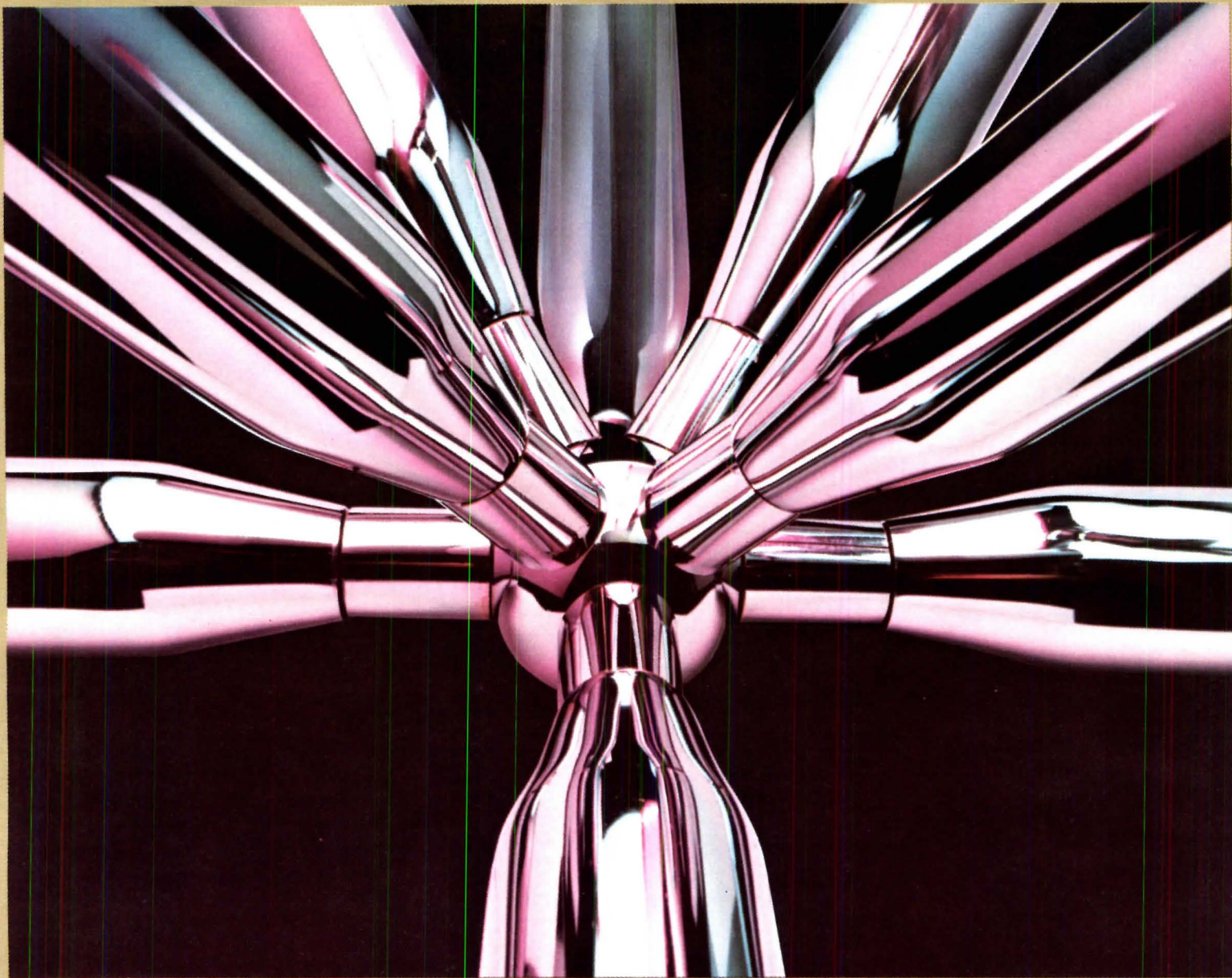
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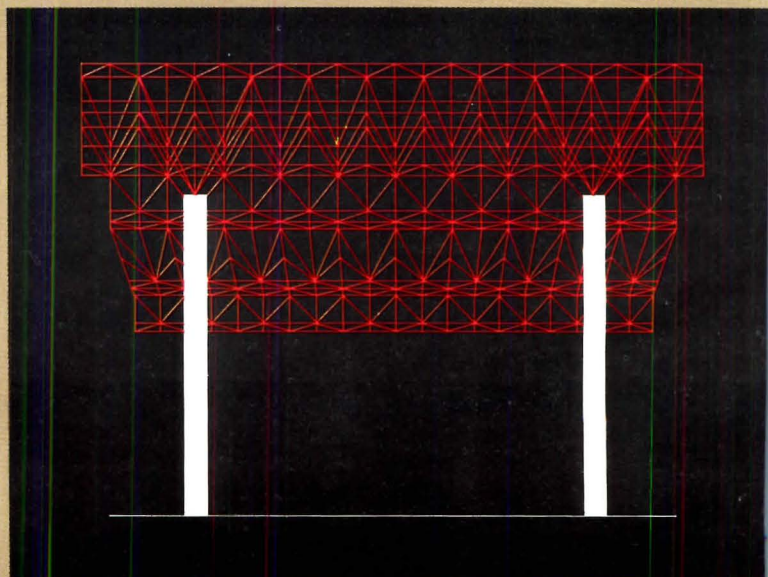
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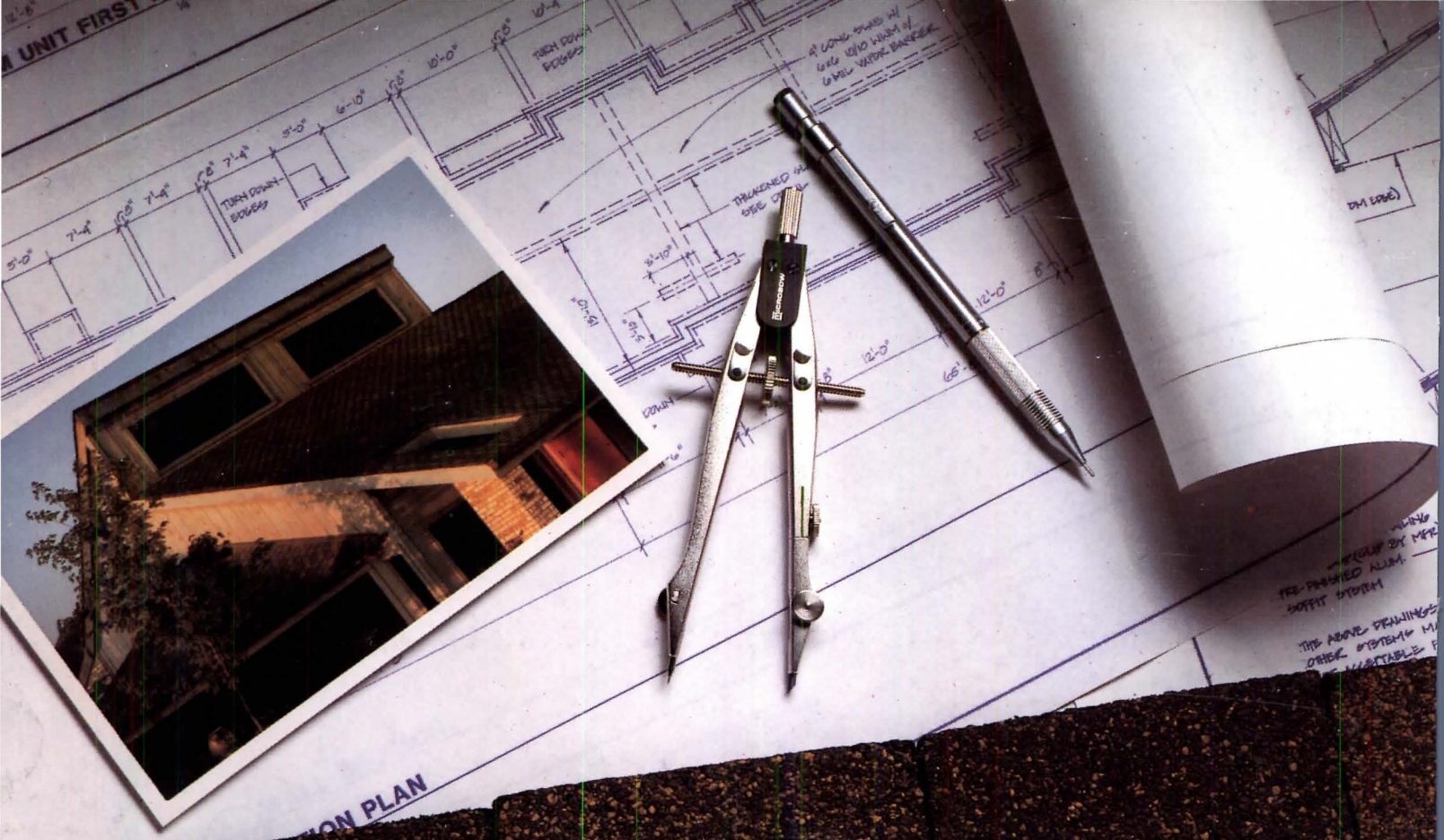
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