RESEARCH&DESIGN
The Quarterly of the AIA Research Corporation

Baseline

Researching Performance Standards for Energy Conscious Design

COMMENTARY

Two views on post-occupancy evaluation

By Robert B. Bechtel

Robert B. Bechtel is president of the Environmental Research & Development Foundation in Tucson, Ariz. and author of Enclosing Behavior, *an influential volume on architecture and human behavior. An accomplished researcher and consultant, he holds a doctorate in psychology from the University of Kansas.*

The articles in the most recent issue of *Research & Design* regarding the use of post-occupancy evaluation raise some fundamental questions about the different ways that architects and social scientists look at the creative process. At the center of the issue are some profound oversimplifications of both the creative process and the goals of POE as well. What is needed is a closer examination of that process to see how POE can contribute.

The creative process is often spoken of as though it were a single kind of event. I suggest that there are many kinds as well as many ways of creating. One of the reasons that some architects feel threatened by POE use is that they correctly perceive that POEs will provide evidence against certain kinds of creativity.

One of the kinds of creativity I am speaking about could be called egocentric. This is the kind of creativity where the artist or creator is exclusively concerned with gratification of his own ego. Other people enter into this process only as admirers. No critics or detractors are tolerated. This type of creative process is best typified by the "master" model in architecture. In many schools, prominent architects are presented as semi-mystical persons whose creativity is so far above the human plane that the only safe role left for us is worship. Such a view acquired an almost cult-like following around Ayn Rand, who proposed her philosophy in such books as *The Fountainhead*.

Another kind of creativity is often expressed by a more forceful impressing of one's views on others. We'll call this paternalism. This differs from a true egocentric mode because the egocentric creator really does not care whether he benefits his clients and colleagues; he merely wants his works to be admired. The paternalist, on the other hand, wants to impose his designs on all humanity because he sincerely believes they will benefit thereby. He is a bit more of a humanist than the egotist, but he has one glaring fault—he never bothers to ask whether humanity does in fact benefit. His basic

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By Hugo G. Blasdel

Hugo G. Blasdel is executive director of the National Architectural Accrediting Board in Washington, D.C. Holding master's and doctoral degrees in architecture from the University of California at Berkeley, he has conducted research in multi-dimensional scaling applied to environmental evaluation.

The field of post-occupancy evaluation described in the July *Research & Design* carries with it a limitation of scope which may need to be challenged if the field is to proceed from an occasionally useful adolescence into an integral, mature part of the design professions.

Designers can and should play a strong role in structuring the issues worthy of POE research, so that the results will be useful in design. The field now appears to focus on the possibly idiosyncratic intent of the individual designer and on the individual project. On that basis, it will be more difficult for POE research to develop the comprehensive and precise generalizations designers need. If the intent of POE is to codify the body of knowledge expressed in the range of good design and to identify the underlying features of a humane architecture, then progress will not come from narrowly based research. Research can, however, be used to identify the shared design expectations of the profession for both user behavior and perception, and to validate those expectations, as hypotheses, through the rigors of scientific method.

The nature of generalization in design differs from that in research. A researcher in the social sciences will publish results only if there is no more than a 5 per cent probability of reporting results due to chance. Elaborate processes have been devised to assure proper identification of those odds, and to improve them. A designer, on the other hand, will choose solutions on the basis of professional judgment, generalizing from the whole range of experience. A designer will also endeavor to make a single design successful in many respects, which confounds any singular effort at hypothesis testing. A POE researcher can begin to evaluate whether an individual design performs as expected, but it will be a long time before accumulated data from many cases can establish patterns of cause and effect.

POE research should show the applicability of its results to a wide range of cases, so that designers can see

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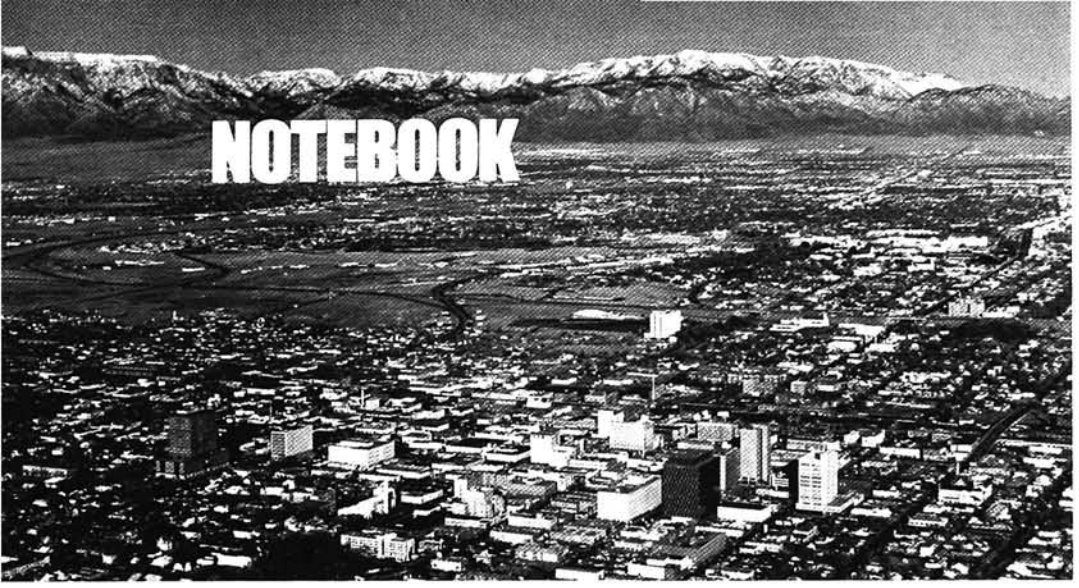
Cover: This "thermogram" of a townhouse attic in Twin Rivers, N.J. was photographed by Richard A. Grot of the National Bureau of Standards during an NBS study of heat loss in residential dwellings. The thermographic process involves scanning an object for infra-red radiation and transmitting the detected information electronically to a standard cathode-ray television picture tube for display. The resultant image, which Grot photographed with a 35 mm. camera, is colored by an encoded color-monitor which assigns specific color values to varying ranges of temperature—yellow-white for hot, red for warm, and blue for cool.



In housing-wise Albuquerque, evaluation means architects

Design evaluation may be growing as a part of architectural practice (*Research & Design,* Vol. 1, No. 3), but its worth in the marketplace is still dependent on the number of clients who consider it a valuable process and believe architects are equipped to carry it out.

Corporate and retail clients seem relatively eager to research human/environment interaction, focused on employee productivity, customer traffic, and similar issues. But at least one key client group—the nation's cities—has yet to be significantly tapped for its design evaluation potential.

Albuquerque may be the exception that proves that rule. The largest city in New Mexico, set in the beautifully rugged central part of the state, Albuquerque has some classic urban problems. More than 35 per cent of its 380,000 citizens are minority (Spanish-American) living at or near the poverty line. Rapid and haphazard postwar growth has resulted in one of the nation's worst examples of urban sprawl. And a '70s downtown renaissance that has seen extensive redesign and rebuilding in Albuquerque's central business district has also heightened pressure on the low income residential neighborhoods directly adjacent to downtown.

Robert McLaughlin, director of the city's housing authority, presides over Albuquerque's sizeable inventory of aging, deteriorating, lowrise single-family housing—the kind of housing one person calls the backbone of a city's indigenous architecture and another considers fodder for urban renewal. Two years ago, that particular argument was raging in Albuquerque. McLaughlin wanted to find out which description was the more accurate, so he chartered a survey and evaluation of Albuquerque's housing. The Design Center, a local CDC run by the University of New Mexico's School of Architecture and Planning, conducted the survey under the guidance of two area consulting designers, Min Kantrowitz and Rob Strell.

Strell and Kantrowitz, with training in both architecture and the social sciences and experience with POE, turned the survey into a kind of design evaluation on the urban scale, assessing not only housing conditions but neighborhood character and social patterns. They learned that Albuquerque's inventory of indigenous housing is a valuable physical asset to the city; and they learned that the residents who populate Albuquerque's older neighborhoods want seriously to preserve the nature and scale of their environment.

One of the neighborhoods they surveyed, North Barelas, is a fairly typical example of Albuquerque's aging, low-income, and largely Spanish-American residential communities. Separated from the CBD only by the breadth of Coal Avenue, North Barelas has long been the envy of developers looking to expand the city's commercial district. One lot—a 3.99-acre vacant tract two blocks from Coal Avenue—has been a particular bone of contention. But five years ago, Republican Mayor Harry Kinney promised residents of North Barelas that the coveted 3.99 acre site would be used for needed elderly housing, designed in keeping with the neighborhood's scale and character—not for commercial development.

Last year pressure mounted on Kinney successor David Rusk (son of the former Secretary of State) to develop the site commercially. But, backed at least in part by the Strell and Kantrowitz research, the new Democratic mayor stuck to his predecessor's pledge.

Albuquerque then took advantage of federal funds committed to the city to put out a local request for proposals to develop the site. Strell and Kantrowitz, by now partners in a four-principal firm called Matrix Architecture/Planning/Research/Solar Consulting, submitted a proposal. Though not the only competitors for the work, they had impressed city administrators with their earlier

Solar update: Congress and the White House opt in, but the market is bear

To crib from Dickens, these may be the best of times and the worst of times for solar energy. Reluctant designers, skeptical financiers, and a government slow to grant tax credits or otherwise stimulate private enterprise have combined with high first costs to keep solar from the design and construction mainstream. Yet both the public and private sectors are today taking what will probably be the seminal steps in America's long-term solar development.

Much of the good solar news is coming out of Washington. Sun Day, organized last May 3 by the Washington-based public interest group Solar Action, marshalled publicity and public interest in solar energy and prompted President Carter

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citywide housing evaluation. Not surprisingly, they got the job.

Using neighborhood interviews and other techniques born of design evaluation, Matrix developed four basic design options for elderly housing on the site. They also set out development alternatives, financial mechanisms, density options, solar potential, and the full range of architectural considerations—from landscaping and building configuration to color, light, and noise recommendations—that might normally be expected of a design proposal.

The firm's final project report reflected both the concerns of the city and those of the neighborhood's residents, and because those inputs were carefully researched, the report pleased both camps. Its primary option will likely reach construction.

Architect and psychologist Min Kantrowitz feels it was her firm's architectural expertise that brought the job to Matrix, though the work was by no means strictly architectural.

"Our mix had a stronger appeal," she says. "We had a researcher, a planner, a psychologist, and an architect. We got the job because we could communicate in architectural lingo. We knew the problems."

Kantrowitz doesn't say so, but she and her colleagues also knew when and how to lead Albuquerque into a relatively new but entirely appropriate evaluation process. New Mexico's largest city, saddled with a problem set typical of many of its

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Philadelphia's Interspace researches office systems for the Senate's new digs

Design research has reached the halls of Congress in the shape of a "Senate Office Systems Research Project" aimed at maximizing effectiveness and productivity in Congressional offices by improving office layouts.

The project, being conducted by Philadelphia-based design researchers Interspace Inc. and overseen by the office of Architect of the Capitol George White, FAIA, is testing new lighting and furniture systems installed in the office suites of five U.S. Senators and two Senate committees, all in preparation for occupancy of 50 new offices in the now-rising Philip Hart Senate Office Building on Capitol Hill.

According to White assistant M. Elliott Carroll, FAIA, the research actually arose in 1973 from a friendship between Sen. Mark Hatfield (D-Ore.) and Herman Miller Corp. President Hugh DePree. When DePree learned that the average Senate office worker's space covers only 67 s.f. (the General Services Administration strives for 125-150 s.f. per person in its offices), he suggested a research project to test new modular office units in Hatfield's office suite.

When the Herman Miller Research Corp. completed its layout test, Hatfield was more than impressed; he claimed that his staff was able to reduce the turnaround time for replying to constituent inquiries from 30 days per inquiry to 24 hours with the new furniture. Hatfield recommended to the Senate Rules Committee (on which he sits) that it appropriate funds for a Senate-wide study of office layouts, which it promptly did.

Interspace became involved in late 1975, tasked first with questioning Senate staffers on their cramped office quarters and their working needs. Specializing in interior design research and programming, Interspace put a con-

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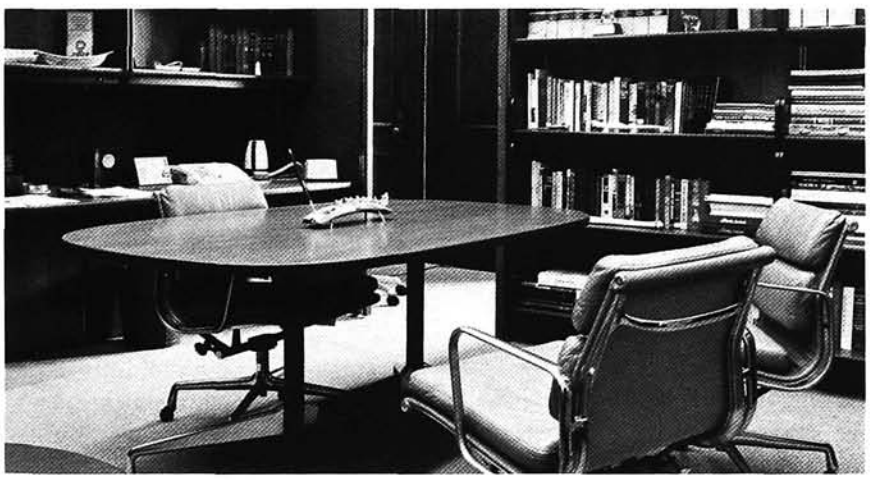
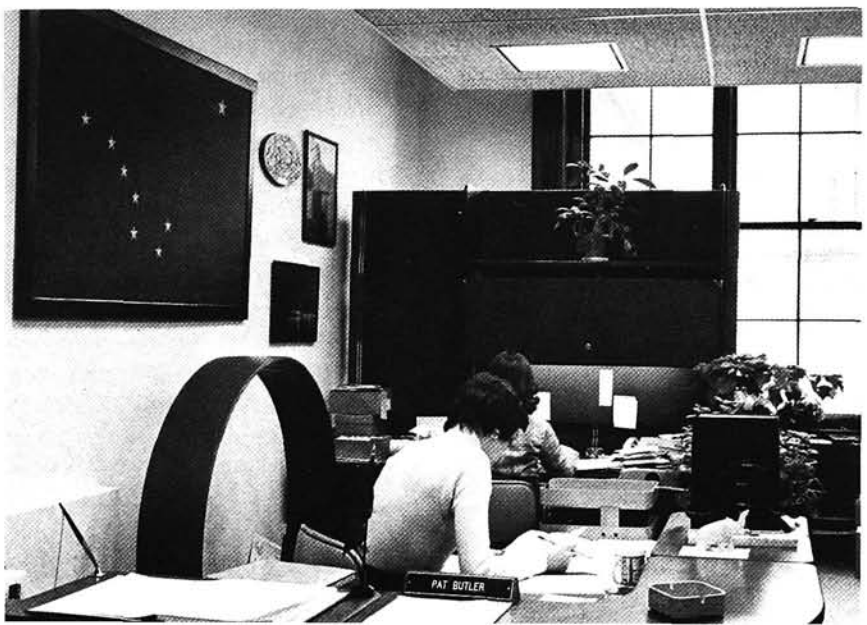




Above, new furniture in the personal office of Sen. Ted Stevens (R-Alaska), installed as part of the Senate Office Systems Research Project. At right, the test configuration in Stevens' outer office.

Summer institutes kindle seismic, energy awareness in design faculty

Architectural faculty are always getting together in the summer to shoot the curricular breeze; it's how most of the nation's programs of professional architectural education come into being.

This summer, the AIA Research Corporation tried a strategy aimed at harnessing that particular activity to bring some key design research issues into the educational mainstream. Three federally-funded Summer Institutes for Architectural Faculty were held over the warm months, two on seismic safety and one on energy conscious design.

The first session was held in late June on the Urbana/Champaign campus of the University of Illinois, one of the nation's earthquake research centers. Under National Science Foundation funding, fifty design faculty—most of them from architectural schools in the East and Midwest—came to the expenses-paid five-day session. They met with some of the architects, engineers, and researchers responsible for the leading work in seismic research and design. In seminars, lectures, and demonstrations at Urbana's shake-table facility, the faculty were exposed to concepts and techniques in the field. Special prerecorded videotape presentations on the fundamental aspects of seismic design—land use planning, building form and configuration, structural considerations, nonstructural hazards, and seismic retrofitting—buttressed follow-up sessions designed to help the faculty work seismic training into their architectural curricula this coming year.

Barry Frazier

Above, Harvard's Gund Hall. Below left, architectural faculty touring the shake-table facility at Stanford's seismic research center.

Eight weeks later, a second institute for 50 more faculty took place on the Palo Alto campus of Stanford University, another major research center. With the format attuned to the characteristics of West Coast seismicity (see *Research & Design,* Vol. I, No. 2 for a look at the differences between eastern and western seismic hazards in the U.S.) faculty at the western seminar went through similar training and came up with their own strategies for working seismic design into architectural curricula.

In late July, another summer session was held in the glassy confines of the Harvard Graduate School of Design's Gund Hall. With the support of the U.S. Department of Energy, AIA/RC brought 44 design faculty from 23 schools of architecture together for a seven-day Summer Institute on Energy Conscious Design.

The week-long session was staffed by consultants—architects, educators, engineers—nationally known for their work in energy conservation, architectural education, and highly aesthetic design.

Like their peers at the seismic sessions, faculty at the Cambridge institute were presented with a fortune in technical and conceptual information. But they moved rapidly from lectures and seminars into design charettes, where they applied energy conserving strategies to design problems created specially for the session.

The faculty were encouraged to approach the design problems in a holistic fashion, taking energy conservation up as a key element of building program from the earliest moment of design.

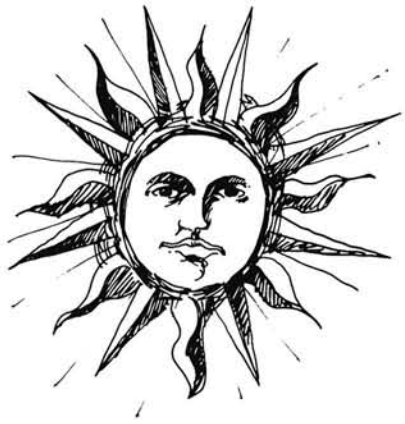
Ranging in discipline from engineering to architectural history to design, the faculty developed cross-disciplinary methods for raising energy consciousness in the educational process in a similarly holistic way. Having come to the institute in multi-disciplinary teams, session participants were expected to return to their schools carrying the holistic approach beyond energy conscious design and into learning itself. The academic year now underway is the testing ground in which that theory will be tried.

Solar update *(continued from page 2)*
to announce plans to mount solar collectors (for domestic hot water) on the White House roof.

Late last month Presidential Aide Hugh Carter and DOE Assistant Secretary Omi Walden finally detailed the White House solar scheme. Six hundred square feet of collector panels will be mounted on the roof of the building's West Wing, which houses offices and the 300-meal-a-day White House commissary. The 600-gallon system, costed at $24,000 for installation and hardware and expected to reach completion this spring, should meet 76 per cent of the West Wing's hot water needs. Supplementing the Executive Mansion's coal and natural gas heating system, it's expected to cut fuel costs by $1,000 per year.

The solar collectors will be visible to visiting dignitaries from the Rose Garden and to the public from the White House's South Lawn—underlining the image-consciousness behind this solar step. DOE's Walden, who heads the department's conservation and solar applications division, called solar technology "no longer an exotic novelty" and termed the White House installation "a major signal to all Americans and indeed the world that the solar age is here."

Congress—at least the House of Representatives—seems similarly



inclined. A House committee has approved $3 million to install 900 solar panels on the roof of the Rayburn House Office Building across Independence Ave. from the Capitol. Linked to a 36,000 gallon hot water storage system, the collectors are expected to meet 46 per cent of the building's water and space heating needs.

The money, which would also pay for a solar installation on another federal building some blocks away, won't actually be debated or appropriated by the full Congress until next spring. Still, the committee's action is regarded as an indication of Congress's willingness to put its money where its mouth is. According to Solar Action Chairman Denis Hayes, the decision "has a certain symbolic importance . . . Congress has been talking about solar energy for a long time, but those folks out Peoria look at Washington and ask themselves, 'Are they hypocrites back there?' So if Congress starts putting solar systems in their own buildings, it's important."

Arguably the most effective solar political action group in the nation, Solar Action is slated for mitosis at year's end. The group will divide into two new and separate organizations: The Solar Lobby, an aptly named industry pressure group to be chaired by Hayes and tasked with stimulating pro-solar programs in Washington, and the Center for Renewable Resources, a non-profit research center expected to operate in energy and related areas.

Formation of a solar lobbying group is regarded as a crucial step by the solar building industry. Both designers concerned with passive solar concepts and manufacturers of solar hardware are desperate for passage of federal and state tax credits that will stimulate passive design and active solar system sales.

An internal Solar Energy Industries Association (SEIA) survey this summer showed sales and production of active solar system components down 90 per cent from expectations—a tailspin attributed to Congress's failure to act on the national energy legislation proposed by the White House. The legislation would give homeowners a 25-30 per cent tax break on solar heating units, prices of which have doubled in the year Congress has held up the energy bill.

The low sales and production figures now afflicting solar component manufacturers are most harmful to small entrepreneurs, many of whom face imminent bankruptcy. But the fact that designers and manufacturers large and small are doing a land-office business in California, Hawaii, Arizona, and New Mexico —where active and passive solar tax credits have been passed—underscores the industry's need to lobby Congress into action.

Ince is AIA/RC's new president

Charles R. Ince Jr., vice president of the AIA Research Corporation since last May and executive administrator of its energy programs since 1976, has been named president of the research group. He succeeds John P. Eberhard, FAIA, president of AIA/RC since its founding.

Ince, 43, was with the Federal Energy Administration (now part of DOE) before his arrival at AIA/RC. As an associate assistant administrator, he directed FEA's Office of Buildings Programs and held responsibility for energy conservation policy and programs affecting private, public, commercial, institutional, and residential buildings. He left FEA in October, 1976 to oversee energy programs for both AIA and AIA/RC.

With B.A. and B.Arch. degrees from Stanford University, Ince has also held design positions with several firms. He has worked as project director with Gardner A. Dailey & Associates and Daniel, Mann, Johnson & Mendendhall, and as vice president with John Carl Warnecke & Associates. He has also served as senior planner at Stanford and planning and program officer with the Strategic Air Command, USAF.

Eberhard, 51, whose resignation as AIA/RC president became effective Aug. 31, was asked to head the newly created Research Corporation in 1973. In the succeeding five years, AIA/RC developed major architectural research programs in solar energy, energy conservation, seismic damage mitigation, and other design fields with national policy implications.

Albuquerque *(continued from page 3)*
urban peers, was sufficiently enlightened to use innovative funding techniques in support of innovative, localized research conducted by local professionals. That, for any city, is an appealing way to solve problems.

The now-rising Hart Senate Office Building will house 50 new offices for Senators and committees.

Senate *(continued from page 3)*
sultant team expert in environmental psychology (the questionnaires), acoustics, lighting, and management systems on the case. By October, 1976, the team had transformed the Senate staffers' comments into recommended test layouts for seven Senate offices, designed to test sound and light levels and space efficiency. New furniture systems were installed, replacing traditional desk and bookshelf arrangements, together with task and ambient lighting fixtures, and the project team has since monitored performance of the systems. Its final report is due to Architect White's office next month.

The immediate goal of the research is to come up with optimum furniture systems (three options for each of seven individual Senators' office layouts and seven committee office layouts) for the Hart Senate Office Building, scheduled for completion in 1981.

According to Carroll, the fact that the House of Representatives has cut off funds for the Senate's new building (the budget looked extravagant with elections approaching) won't slow the work schedule or postpone occupancy. The Senate will reappropriate funds to complete the $122.5 million building before money already in hand runs out.

Eventually the office systems research will reach beyond the new building to older Senate offices and to the House side as well (the House actually considered doing a office system research project of its own, but decided to wait and see how the Senate's worked out). Thus, Interspace's design research will eventually revamp entirely the way members of Congress spend their legislative days.

Notes

Preliminary results from the first phase of a DOE-sponsored study of **energy consumption in modern office buildings** prove what you may have known already—that office structures designed and built prior to World War II are generally much more energy efficient than those of the postwar era . . . *ENERGY,* the newsletter of AIA's Energy Notebook, reports that average consumption for postwar buildings studied is 112,000 BTUs per square foot per year; the older buildings average between 60,000 and 70,000 BTUs per square foot annually . . . Among other findings from the project: energy consumption could be cut as much as 22 per cent in office buildings with relatively inexpensive conservation features, including better HVAC control, reduced inflow of outside air, energy efficient lighting systems, and individual control of light switches and rheostats. Estimated payback time for such measures averages only three years. Engineers **Syska & Hennessy** and the **Tishman Research Corp.** are major contractors on the DOE-funded study, phase one of which ended early this year. Scheduled for completion in 1979, the project is studying 1,037 office buildings in New York City; in-depth examination is slated for 44 of the structures...

Mounir M. Botros has authored, for the Army Facilities Engineering Support Agency, a key report on **artificial lighting and energy conservation.** Botros' thesis, echoed in DOE's office-building study and several other current lighting projects, is that the key to conserving lighting energy lies in system control. The report details control systems and evaluates the impact on conservation of balancing artificial and natural light. It's available for $4.50 under the title **Lighting Design and Energy Conservation** from NTIS, 5285 Port Royal Road, Springfield, Va. 22161...

NBS, researching performance

criteria on which to base **building energy conservation standards,** has completed a study designed to establish a common economic value level for energy. **Dr. Stephen Weber,** leading the Center for Building Technology study, weighed two alternatives in the project: establishing an energy value keyed to actual market prices, or establishing a value adjusted to reflect total value to the nation—accounting for environmental, social, institutional, and national interest factors in addition to market price. Weber's study team recommends the latter approach, keyed to a system of multiplicative factors called Resource Impact Factors (RIFs) applied to market prices. Look for an upcoming report on the project in NBS Building Science Series 14 . . .

NBS published close to 1,900 scientific and technical papers last year, on subjects ranging "from A (abnormal loading of structures) to Z (zero-shift in pressure measurement)" and totaling 46,021 printed pages. On the theory that there must be something useful in there, you might want to order NBS's catalog of the '77 publications. It's **1977 Publications of the National Bureau of Standards,** and it lists research papers, interagency reports, building science series, monographs, voluntary product standards, technical notes, patent citations, grantee-contract reports from NBS contractors, and other potentially valuable stuff, all abstracted, all with how-to-get-it information. The cost is $7.50, the order number 003-003-01951-8 . . .

International Resource Development Inc., a Connecticut based market research firm, has made an interesting prognostication based on some recent research: According to IRD, current trends in the marketing of home computer and video cassette/recording systems point to the emergence of an integrated video terminal (IVT) integrating the home television set, telephone, personal computer, and video recording unit. IRD predicts that the multi-system units will arrive within 4 years, cost about $1,400, represent a billion-dollar industry within ten years, and have a significant impact on dwelling design because of their centralizing impact on home life. If you buy the notion, contact IRD at 125 Elm St., P.O. Box 1131, New Canaan, Conn. 06840 (tel. 203/966-5615) for more information . . .

The 1979 U.S. National Conference on Earthquake Engineering is scheduled for Aug. 22-24, 1979 at Stanford University in Palo Alto, and papers for the conference are already being invited. All areas of earthquake engineering research and design are viable topic areas. Papers will be accepted in two categories: (a) state-of-the-art reviews and (b) new research. Prospective authors must have abstracts in by January 8; final manuscripts will be due in April . . . For all the regulations, contact the sponsoring Earthquake Engineering Research Institute (AIA is a cooperating sponsor), 2620 Telegraph Ave., Berkeley, Calif. 94704 . . .

Yet another evaluation of solar energy's future has been made, this one by the **Office of Technology Assessment,** advisor to the Congress on matters technological. OTA says expected reductions in current solar costs, combined with price increases for other energy forms, will make on-site residential, commercial, and industrial solar systems cost-competitive on a life-cycle basis within ten years. Small-scale solar development will occur independently, OTA predicts, but without government assistance solar energy won't make a significant contribution to U.S. energy resources before the year 2000 . . .

A final note . . . **The Center for Building Technology** at NBS is researching some interesting subjects currently, among them the effect on masonry of herbicides used to keep structures free of destructive vegetation; user performance in energy conservation systems which require user participation (like lowering window blinds); U.S. and world metric building trends, and characteristics and preservation techniques for adobe structures.

Coming up

24-25 Oct.: Gaithersburg, Md. National Conference on Uniformity in Construction Documentation. Contact: Center for Building Technology, National Bureau of Standards, U.S. Department of Commerce, Washington, D.C. 20234.
13-15 Nov.: New York City. Solar Energy Seminar. Contact: New York Management Center Inc., 360 Lexington Ave., New York, N.Y. 10017, tel. 212/935-7272.
14-15 Nov.: Henrietta, N.Y. Energy Conservation Products Show. Contact: David C. Moss, 75 College Ave., Rochester, N.Y. 14607.
15-16 Nov.: Miami Beach. Solar Energy Applications Conference. Contact: American Institute of Chemical Engineers, 345 E. 47th St., New York, N.Y. 10017, tel. 212/644-7526.
26-29 Nov.: San Francisco. Second International Conference on Microzonation for Safer Construction Research and Application. Contact: M. A. Sherif, 132 More Hall, FX-10, University of Washington, Seattle, Wash. 98195, tel. 206/543-6777.
4-6 Dec.: Miami Beach. The 1978 Winter Computer Simulation Conference. Contact: Dr. N. R. Nielson, Information Science Library (J-1041), SRI International, 333 Ravenswood Ave., Menlo Park, Calif. 94025, tel. 415/326-6200.
11-13 Dec.: Miami Beach. Commercialization of Solar and Conservation Technologies Symposium. Contact: Dr. T. Nejat Veziroglu, Clean Energy Research Institute, University of Miami, P.O. Box 248294, Coral Gables, Fla. 33124.

Energy Performance Standards

Baseline

By Ray Rhinehart

For the past 18 months, hundreds of designers and researchers have been at work on what has been called the largest project of architectural research in U.S. history. Its object: To lay the groundwork for standards that will affect the energy performance—and likely the shape—of every building erected in America from 1980 on.

Nineteenth-century English essayist Charles Lamb tells the story of how *sus scrofa,* the common pig, became a gastronomic delight. Lamb's narrative begins many years ago, in China, when pigs were seen everywhere—everywhere except on the supper table. One day, in a province far from Peking, a farmer's barn caught fire. Most of the farmer's livestock escaped unsinged, save one foolish, slothful pig.

When the fire at last died down and the disconsolate farmer went out to poke through the ashes of his barn, a curious event took place. From out of the smoldering ruin arose an aroma so sweet, so delicate, that the farmer's grief was swallowed by the pangs of awakening appetite. There among the glowing embers crackled the succulently fricaseed remains of hapless *sus scrofa.*

News of this miracle travelled rapidly through the provinces. Soon, throughout the land, peasant and lord alike were herding pigs into barns, as well as into temples, shops, and even their homes, after which they applied the torch—all for a crack at some ribs and barbeque.

The people of this great empire were well on the way to becoming homeless and unemployed until someone came along and demonstrated that a more efficient use of fuel could achieve the desired results, without sacrificing comfort and convenience.

Lamb's porcine tale serves us today as a reminder, albeit roundabout, that we have been as blindly profligate in our consumption of energy as these scarcely-remembered gourmands. We have been content to set fire to our limited energy resources as long as the bills have remained low. But lately the bills have run double-digit.

What is threatened by the energy crisis is a standard of living most Americans have come to accept as one of their inalienable rights. Which is why Congress finally stepped in back in 1976, in the wake of oil embargo, with the passage of the landmark Energy Conservation and Production Act, Public Law 94-385.

Title III of that piece of legislation specifically enlisted the help of American designers in the nation's energy crisis. Congress clearly wanted to encourage energy-conserving design—and for good reason, when one considers that approximately a third of all the energy consumed in this country is used in the built environment.

But to do this—to encourage and set goals for energy-conserving design—required information that up to now has been in short supply. Needed first was to know how present buildings are designed to perform in terms of energy consumption. Needed too was to know how much better designers can do—and how fast.

Why, as has happened, have the answers to these questions come to be the responsibility of architects and engineers? Why hasn't the federal government simply prescribed a solution instead of waiting for word to come from America's drafting boards? And how have American designers responded to the challenge?

This is the story spelled out here. It is the story of the development of a unique research effort that has allowed

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Ray Rhinehart is a Washington-based freelance writer interested in the arts and public policy.

architects, engineers, and other building industry professionals to influence the decision makers who will be constructing the nation's energy conservation policy in the near future. It's a story about how the designers who have participated in this project have designed buildings that may not only consume less energy, but constitute more responsive design as well. And it's the story of a project whose eventual conclusions may reinforce an ethic of growing importance in American architecture: Form Follows Energy.

Energy Performance Standards

The Energy Conservation and Production Act of 1976 mandated the development of energy performance standards for the design of new buildings by 1980. Of special importance in the law was the caveat that the standards be performance-oriented, rather than prescriptive. In other words, the standards would focus on whole buildings, rather than their parts.

A current analogy illustrates the crucial dichotomy between performance and prescriptive approaches: The U.S. Department of Transportation (DOT) sets fuel consumption targets for new cars. Automotive designers are required to meet these targets according to a schedule worked out between DOT and the manufacturers. DOT does not dictate *how* car manufacturers should design their products—only that those products achieve specified levels of fuel efficiency. The approach—a performance approach—doesn't restrict the art of automobile design; it accommodates the developments of technology and design innovation.

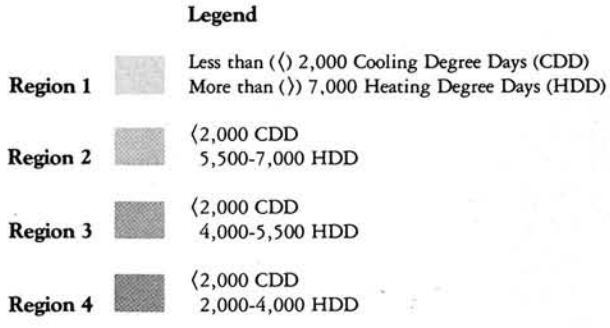
During the legislative debate prior to passage of the Energy Conservation Act, it was successfully argued that performance standards, unlike prescriptive, would neither constrain design nor freeze technology at a certain limited point. It was also argued that the performance approach would do more to encourage conservation.

So Title III of Public Law 94-385 called for design standards in terms of goals to be met without specification of methods, materials, or processes. The standards are to encourage maximum practicable improvements in energy efficiency and increased use of non-depletable energy resources. Specifically, the standards are to be applied at the design stage of each building, before its construction; they are to take the form of energy budgets, putting a ceiling, for example, on consumption of BTUs per square foot per year; they must reflect the relative difficulties of conserving energy in different climates, and they should be based on the differing intended uses of building types.

Originally, responsibility for developing and implementing these standards fell to the Department of Housing and Urban Development (HUD). Later, the law establishing the new Department of Energy (DOE) transferred much of this responsibility to DOE. Since that time, the two departments have been cooperating in the development program.

In order to develop standards that satisfied the intent of the legislation, DOE and HUD had first to define "performance." The term "designed energy performance" was coined; that is, the energy consumption of a building *as estimated from the design* using a typical set of assumptions about building occupancy and operation, as well as weather and climate. HUD and DOE had also to determine the designed energy performance of buildings in three situations: As originally designed in 1975 or 1976, after the oil embargo; as hypothetically designed to component energy standards existing in 1978, and, also hypothetically, as designed to the maximum levels of energy conservation practicable by designers today. With quantification of these three situations in hand, HUD and DOE would develop interim energy performance standards to be tested prior to the August, 1979 deadline for the final standards.

The first steps in the Baseline research, designed to facilitate a survey of the current state of energy conserving design, were to chart the nation's climatic variations and choose representative sites for a nationwide survey of building energy consumption. The climatic information came from the National Oceanic and Atmospheric Administration's most current data on heating and cooling degree days. Then 37 urban areas—statistically referred to as Standard Metropolitan Statistical Areas, or SMSAs—were selected as survey locations for their geographic and climatic spread. During Phase 1 of the research commercial and residential buildings spanning 16 building types were surveyed for energy consumption in the 37 SMSAs. Later, during Phase 2, commercial redesigns and residential prototype designs aimed at cutting consumption were sited in the same locations.

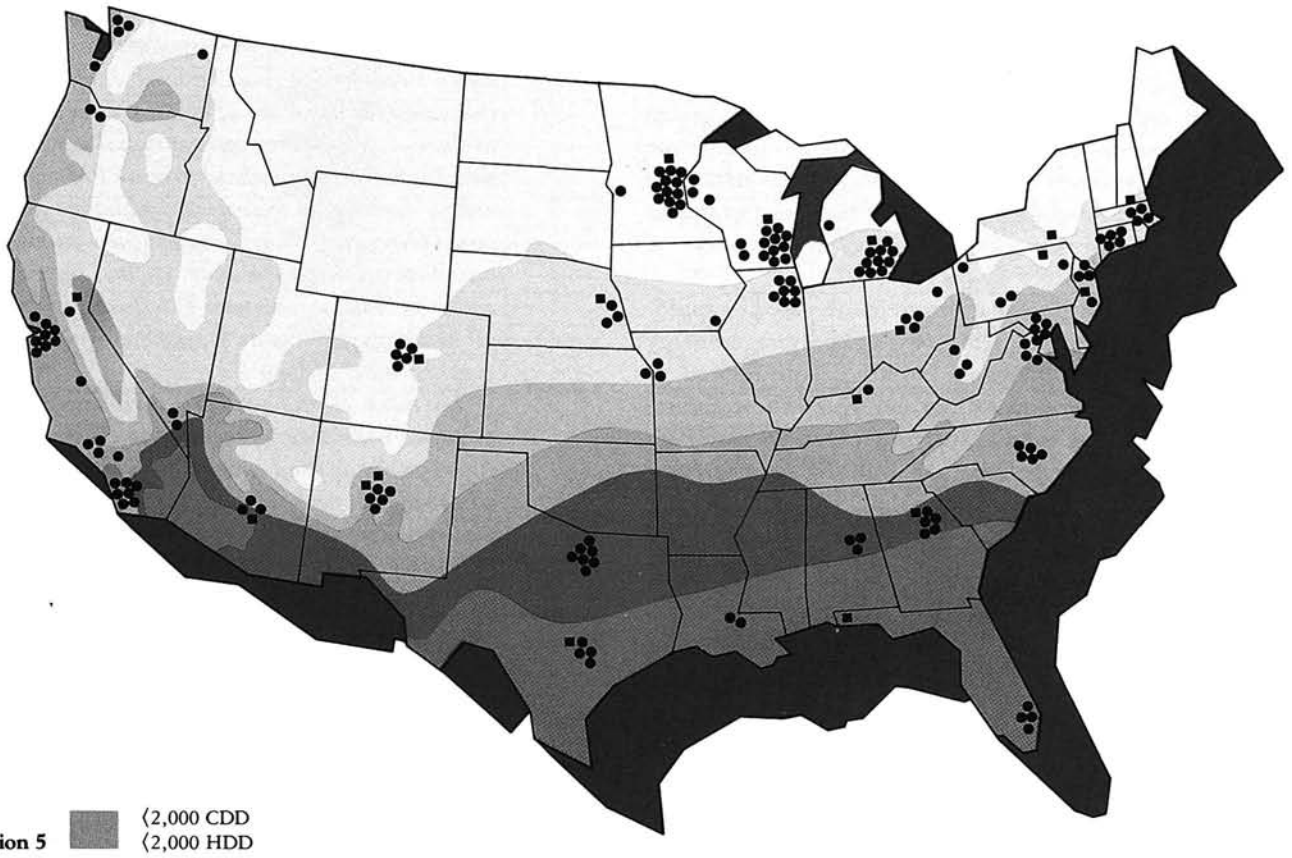


That was the genesis of a two-phase research project, carried out by the AIA Research Corporation over the past 18 months, which has cost upwards of $9 million and involved close to 200 design projects and more than 750 practicing design professionals across the country. Officially the project has been referred to as "Research for the Development of Energy Performance Standards for New Buildings." Unofficially, it has been called simply the Baseline Project. It has also been called the largest architectural research project ever undertaken in the United States.

Phase 1

The first task facing the Baseline Project was to document the designed energy performance of today's new buildings.

The research for Phase 1 of the project began in May, 1977. HUD contracted with the AIA Research Corporation (AIA/RC) to collect data on designed energy per-



Region 5 ⟨2,000 CDD ⟨2,000 HDD

Region 6 ⟩2,000 CDD ⟨2,000 HDD

Region 7 ⟩2,000 CDD 2,000-4,000 HDD

● Phase 2 Commercial redesign sites

■ Phase 2 Residential prototype design sites

formance resulting from current practice. In order to ensure that all technical concerns would be addressed in its research, AIA/RC established a Technical Advisory Group (TAG) consisting of representatives from AIA, the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), the American Consulting Engineers Council (ACEC), the National Society of Professional Engineers (NSPE), the Illuminating Engineering Society (IES), the National Association of Homebuilders (NAHB), and the Manufactured Housing Institute (MHI). The broad range of experience within the TAG provided the project with interdisciplinary guidance and technical advice.

To quantify designed energy performance, the project's first order of research was to create a statistically representative sample of American buildings, from which generalizations of reasonable accuracy could be made about the nation's building population as a whole. It was decided that the buildings to be surveyed in the project were all to have been constructed in 1975 and 1976; they represented the first generation of buildings designed after the 1973 oil embargo for which complete data were available (the assumption was that energy conservation became of increased importance to both designers and their clients in the shadow of the embargo).

A classification system for building types was developed from the occupancy descriptions in building codes. For purposes of data collection, a broader classification scheme was drawn from this system. It included 12 building types defined for the project as "commercial"—offices, elementary schools, secondary schools, colleges/universities, hospitals, clinics, assembly centers, mercantile facilities, warehouses, residential nonhousekeeping units, restaurants, and highrise multi-family dwellings—and four types defined as "residential"—lowrise multi-family, single-family detached, single-family attached, and mobile homes—for a total of 16 building types.

At the same time, after examining several existing models, the project group developed a system that would chart the effects of climate on building energy performance and encompass the broad range of climatic variations across the country. Seven climatic regions, based on combinations of heating and cooling degree days, were delineated within the contiguous United States.

The twin classification systems of building type and climatic region laid the foundation for data gathering in the research. A full range of data on construction characteristics and use requirements was collected from a random sample of commercial building designers in a special six-page survey form. Information on energy-related characteristics in residential construction and mobile homes was collected and analyzed by the subcontracting National Association of Home Builders Research Foundation (NAHB/RF). All told, the project's first phase identified a representative sample encompassing approximately 80 per cent of all the commercial/non-industrial buildings designed in 1975-76 (some building types for which low construction volume is anticipated in the near future—railroad terminals, large stadium facilities, correctional institutions—were not included) and virtually all of the multi-family, single-family, and mobile homes constructed in the same period.

The information collected from the sample was used to calculate designed energy performance. In the case of commercial structures, a short-form version of a computer program called AXCESS was used to simulate actual energy consumption from building designs. To estimate the energy performance from the residential data, the modified degree day method was computerized to reduce the processing time required for the large number of buildings.

The results of the calculations were tabulated by building type and climatic region, with the average energy performance of the sampled buildings summarized in terms of BTUs per square foot per year. These figures included the most significant uses of energy for each category—heating, cooling, and lighting for the commercial buildings; heating and cooling for the residential.

Thus the "baseline" itself—a picture of the designed energy performance of a representative sample of recent building designs throughout the contiguous United States—was established. For the first time, there was documented evidence on the actual state of architectural design in relation to energy consumption, circa 1975-76.

Left to be answered still were questions of how the same buildings would use energy if they were designed in accordance with energy component standards in existence in 1978, and if they were designed to the maximum levels of energy conservation available from architects today. These were questions for which new research procedures had to be developed, procedures capable of gathering and correlating information on *hypothetical* designs. That, among other things, was the task of Phase 2.

Phase 2

Although Phase 2 represented an entirely new research effort for Baseline's project group, it was still closely related to the initial Phase 1 work. With some modifications, the building classification scheme and the seven climatic regions were carried over. The 16 building types in the Phase 1 classification scheme were expanded to 21 types; the commercial group included large offices, small offices, elementary schools, secondary schools, hospitals, clinics, assembly centers, stores, shopping centers, warehouses, nursing homes, hotels/motels, restaurants, fast-food restaurants, highrise multi-family dwellings, and lowrise multi-family dwellings; the residential group included one-story detached, two-story detached, multi-level detached, townhouse attached, and—in a third and separate category—mobile homes.

As in Phase 1, designers of commercial buildings were asked to supply energy-related design data on their original buildings. AIA/RC again contracted with NAHB/RF to provide this information for single-family residential dwellings, and the analysis of mobile homes was carried out by subcontractors T. R. Arnold and Associates.

The designed energy performance of buildings as if designed to existing energy standards was determined by modifying the data for the original Phase 1 buildings to comply with the minimum (or maximum) requirements of the appropriate existing standard—ASHRAE's 90-75R, HUD's Minimum Property Standards, NAHB's Thermal Performance Guidelines—and feeding the modified data into the computer to assess ranges of energy performance.

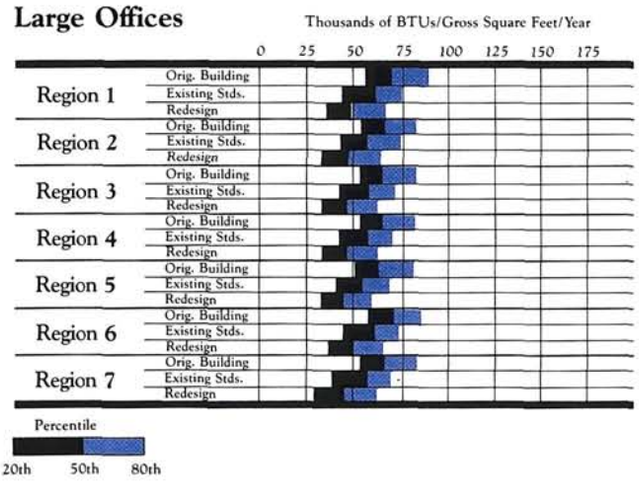
Developing the research process to estimate the energy performance of buildings designed to be maximally energy efficient by today's designers was a different matter. AIA/RC concluded that the research would in fact require surveying three different products—commercial buildings (including multi-family residences), single-family dwellings, and mobile homes—each with its own discreet design and construction technologies, and each with significantly different energy requirements.

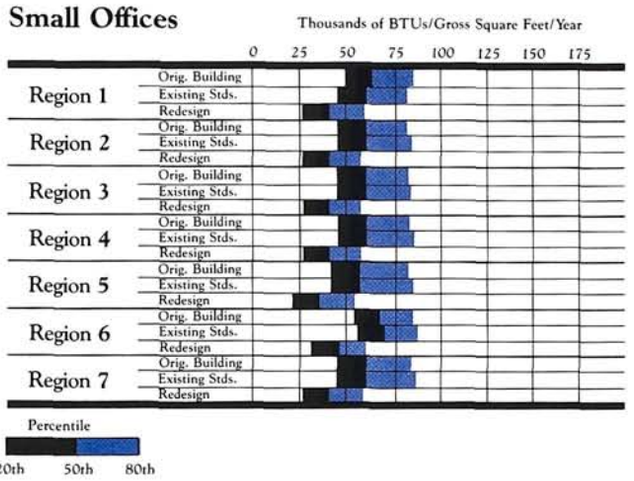
That conclusion led to different ways in which data on potential energy conservation were gathered for single-family dwellings and mobile homes on one hand, and commercial buildings together with multi-family residences on the other.

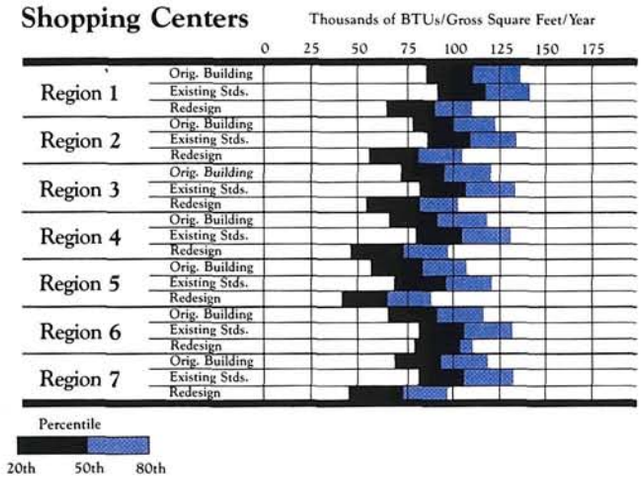
Using the earliest preliminary data to come in from Baseline's second phase, the researchers identified potential trends for energy conservation, illustrated in these tables for four of the 21 building types analyzed in Phase 2. The figures represent initial statistically-derived estimates extrapolated from the Phase 2 data using a combination of computer simulations of "designed energy performance" and designers' estimates of actual consumption for heating, cooling, lighting, and other building functions. The final estimates for all building types—yet to be tabulated—will use the complete results of Phase 2's research.

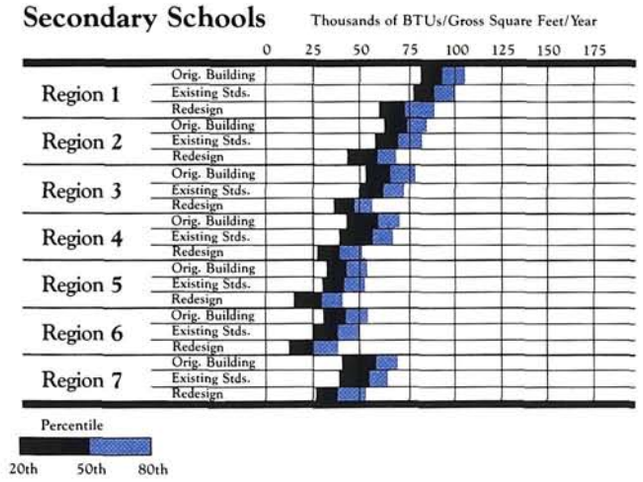
The trends charted here apply to the same buildings monitored under three separate design circumstances: As originally designed circa 1975, in the wake of the oil embargo; as modified to the exact minimum requirements of existing component energy standards (here the research objectives called for a strict "boundary condition" analysis not related to the design opportunities and constraints that would apply to a "real world" application of the standards); and as totally redesigned by the original designers as part of Phase 2, with the full load of "real world" opportunities and constraints and with energy conservation as a leading priority.

As these tables indicate, the preliminary trends are toward marked conservation. In large offices, for example (upper left chart), the estimates indicate that 50 per cent of the large offices designed circa 1975 in Region 1 consume 70,000 BTUs or less per gross square foot per year. Modified to existing standard minimums, consumption drops to an estimated 60,000 or less at the 50th percentile. Reconceived by the original designers with an emphasis on energy conservation, consumption in the same buildings drops to only 50,000 BTUs or less at the 50th percentile.









Commercial Redesigns

The potential designed energy performance of commercial buildings and multi-family residences was derived by inviting Phase 1 survey respondents to take another look—an energy conserving look—at what they had been doing. By demonstrating during Phase 2 what they could do in a complete energy-conscious redesign of their original buildings, the designers would set realistic limits for the eventual establishment of energy budgets.

Throughout the ensuing redesign process, the phrase "state-of-the-art" was used in a precise way. It was not defined as the leading edge of technology, or as what might be theoretically possible. Rather, it described the levels of energy conservation that a cross-section of design practitioners could actually achieve. The project's designers would be describing how technology can be used today. In this way, the figures from which energy budgets would be developed by HUD and DOE would both reflect the real world and represent a target for the design profession as a whole—a target developed by designers themselves, and for which they would be at least in part accountable.

The commercial/multi-family residential redesign exercise was defined as a total redesign of the original Phase 1 buildings, not merely a retrofit. The architects and engineers who participated in the project were to work out a fresh concept, just short of the working drawing stage, for each building.

The rules of the redesign were specific. Designers were to retain the original site and functional program. Otherwise, they were free to change orientation, form, envelope, and mechanical and electrical systems of the building. Active solar and wind systems were not allowed (unless used in the building's original design), and manipulation of raw source energy (that is, produced at the power plant) was ruled out as beyond the scope of this project.

Both the rules of the redesign and the design process itself were so framed that the 168 design teams who eventually participated in the commercial/multi-family redesign part of the project were to demonstrate what was in their own professional judgment technically possible, and yet keep in mind that their designs would influence the standards they would have to meet in the future.

How did these 168 buildings come to be selected? In fact, why 168 redesign teams in the first place? The answers to both questions provide an insight into the complexity of the Phase 2 research process.

The procedure to determine the Phase 2 commercial/multi-family sample was devised to meet specific criteria. First, the sample had to be workable within the project's budget. The estimated cost of each redesign indicated that the largest sample the budget would permit was about 170 buildings, or about 11 buildings for each of the 16 commercial/multi-family building types in Phase 2.

This sample then had to meet several criteria. It had to be stratified to represent each building type that had been examined in Phase 1 along with multi-family lowrise designs, which had been reassigned to the commercial category; it had to represent each major energy budget class (which is a way of classifying buildings by climatic

and operating variables and design); and it had to proportionately represent the numbers of buildings by type in the Phase 1 sample, again including multi-family lowrise.

Through the use of a stratification matrix based on these three variables, the researchers established a process by which a representative sample of the larger Phase 1 building population could be selected randomly. This also ensured a fair and equitable selection of teams for the redesign.

On Jan. 18, 1978, proposal requests were mailed to approximately 1,800 firms. After the closing date of Feb. 6, project proposals in each of the building type/regional categories were opened according to a random sample listing sequence. As opened in sequence, each submission was evaluated according to its compliance with the instructions and its price. If all instructions were met, if the final negotiated fee came within 10 per cent tolerance of the fee estimated in advance by the project group, and if the same firm had not already received an award for another project, a contract award was made. If satisfactory compensation could not be negotiated, the contract next listed in the random sample sequence was opened and the process repeated. All awards for the commercial/multi-family redesign teams were made by March 6.

After providing detailed energy related information on their original buildings (which would be modified and simulated to ascertain designed energy performance in compliance with existing HUD and ASHRAE standards), the teams were ready to begin the redesigns.

A network of information in the form of materials, people, and activities had to be provided to the redesign teams to ensure that all who participated in this exercise understood the redesign problem in the same terms and would work toward designs that were not only energy efficient but good architecture as well. This technical assistance was the focus of a national meeting called Energy Inform, held in Santa Monica, Calif. in March.

In addition to the national redesign information seminar in Santa Monica, the design teams attended regional Data Requirement Workshops and Preliminary and Pre-final Design Reviews. The sessions were conducted by the AIA/RC project staff and selected professionals in energy-conserving design. Both of the reviews constituted a check on the progress of the teams and offered an opportunity for additional technical assistance. The redesign teams also critiqued each other's work. Following the Pre-final Reviews, the redesign teams completed and submitted their projects.

Residential Prototype Designs

The potential designed energy performance of residential buildings was assessed in a different way; it was developed from new prototypical designs of single-family dwellings and mobile homes.

Twenty design teams for the single-family residential exercise were selected from proposals submitted in response to AIA/RC's requests, which were sent to more than 200 firms and individuals recognized for their experience, innovation, and interest in energy-conserving residential design.

Each team—which included an architect, a mechanical engineer, and in some cases a homebuilder—was to develop a prototypical design for a dwelling that would achieve the maximum technically feasible level of energy conservation using available conservation technologies and design strategies, without the use of active solar or wind systems.

Design development included (but was not limited to) considerations of building shape, envelope, internal spatial arrangement, mechanical and electrical systems, lighting, landscaping, and siting. Also, each prototypical dwelling was to respond to four alternative entrance orientations, and mechanical systems were to be designed for all available fuel types. Submissions included documentation of design alternatives, annotated final design drawings, detailed final cost and energy consumption estimates, and a completed data input form.

In addition to the building program and other general requirements, the project's staff and consultants developed guidelines for the designers, stipulating that their designs provide currently acceptable levels of human comfort within reasonable ranges of variation, meet requirements for life safety, and be practicable in terms of available materials, construction techniques, and skills. This was the problem faced by 20 design teams with four weeks to perform their work, beginning last July 3.

The development of prototypical designs for mobile homes followed a related but somewhat different procedure, one that responded to their unique characteristics. AIA/RC contracted with T. R. Arnold and Associates, a consulting firm recognized for its work in the manufactured housing industry, to assess how much less energy the mobile homes surveyed in Phase 1 could be designed to use. TRAA subsequently produced "maximum technically feasible" designs, and these were compared with mobile homes that had been designed to meet the existing National Mobile Home Construction and Safety Standards and the proposed FHA Minimum Property Standards.

Because of the complexity and scope of both the redesign and the prototypical design tasks, and because building designers would, therefore, be paid for their participation in developing the data for Phase 2, not so large a sample of buildings was surveyed as in Phase 1. However, the data-gathering procedure in Phase 2 was carefully designed to maintain the representative nature of the original sample. Only in this way would it be possible to derive general statements with respect to building type and climate.

Assessing the Results

What came of it all? Comparative sets of designed energy performance data were generated and a format to interpret this data was developed. Both constitute information to be used by HUD and DOE in the development of energy performance standards. Also, a research tool based on building types and climatic regions had been created for gathering design performance data, a research tool that had not existed before.

What about the designed-in energy savings of the commercial/multi-family redesigns and the residential prototype designs? The figures reveal that factoring energy consciousness into the design process can indeed lead to more conservation of energy than 1975-76 design prac-

(Continued on page 18)

Energy Inform: Learning to redesign in Santa Monica

How do you incorporate a creative process like design into the constraints of a carefully managed research process?

That was one of the key questions facing the Baseline Project staff when it decided to bring 168 teams of architects and engineers—a cross-section of American designers—into the energy conscious redesign phase of its research. Faced with the complete energy conserving redesign of 168 existing buildings, the design teams had to be exposed to the best of today's conservation design technology, but in such a way that their redesign strategies would be the creative results of their own professional judgment, not just a recital of their recent learning.

The solution came in a novel three-day information seminar called Energy Inform.

Early into the Baseline Project, before the redesign proposals and design teams had been selected, information on energy conserving architecture, engineering, and technology was assembled by the Baseline staff. Then, last winter, the project group met with its specially created Educational Advisory Group—the members were nationally known designers, educators, and researchers Michael Brill, Ralph Knowles, William Mitchell, and Richard Saul Wurman — to develop a presentation format that would encourage assimilation and integration of this information without prejudicing the redesigns.

The product was Energy Inform, a national seminar held last March 19-21 in Santa Monica, Calif., attended by all of the designers participating in the redesign project.

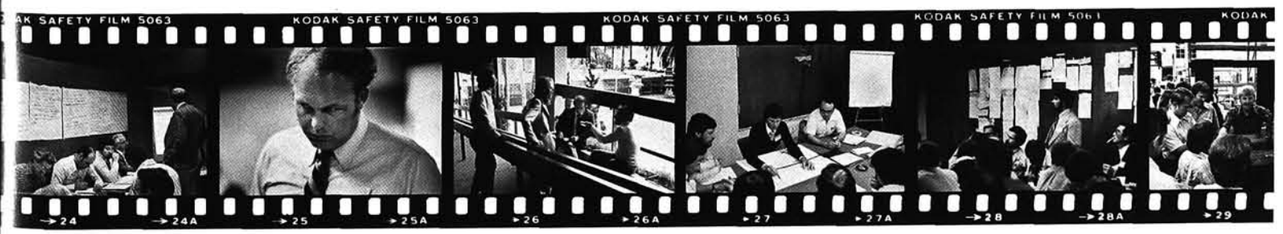
Each of the 168 redesign teams attending Energy Inform received a 160-page manual developed specially for the session by Baseline's consultants and staff. Couched in two formats—background information and modes of conservation—the manual presented a full range of energy conserving design strategies. It also reflected the conceptual basis of the Baseline Project—that designers working with energy conservation as a primary program factor may design buildings that are not only energy conserving, but which take new and highly aesthetic shapes directly linked to their energy performance.

Conceiving of a structure as an organic entity tied to its natural environment, consultant Knowles applied a framework drawn from nature to the Energy Inform material. Key elements of *location* (orientation and siting), *form* (shape and structure), and *metabolism* (mechanical and electrical systems) unite in the Knowles framework to form a holistic approach to energy conserving design. It was from this perspective that the Baseline redesign teams worked energy conserving strategies into their redesigns literally from the ground up.

The redesign participants also frequented a special Resource Center created for the Santa Monica session, and met with assembled energy specialists for presentations on a variety of energy design approaches and guidance on particular redesign problems.

Nor was the session all lectures and reading. Throughout their stay in Santa Monica, the redesigners were in design charettes, working through their design problems and presenting their solutions to project consultants and the other redesigners for critiquing.

All told, the workload at the three-day session was challenging in the extreme. Yet the redesigners absorbed the barrage of new information and turned it around in some innovative and highly successful redesigns. Which may be why, four months after Santa Monica, many of the participating designers called the challenging seminar the high water mark of the entire project.



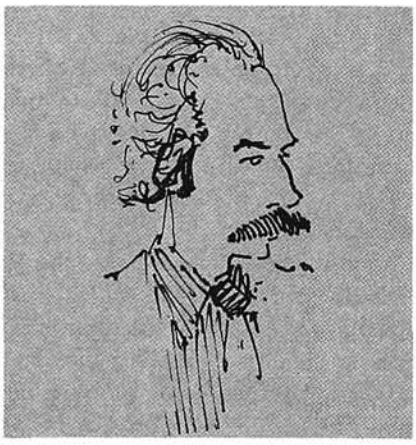
Feedback: Reactions from the designers

One of the Baseline Project's key elements was its inclusion of close to 200 practicing American designers in its research. In many ways, the project was more about them than it was about energy performance standards, because the standards that eventually come out will be based on *their* ability to absorb the energy conscious design strategies presented to them during the project, and to integrate that new knowledge into energy-conserving designs that are both efficient and aesthetic.

At the close of the Baseline research, the architects and engineers who participated in the commercial redesign and residential prototype design portions of the project were asked for their assessment of Baseline. They came back with some very frank comments on the project, on performance standards, on energy conscious design and its implications for the practice of architecture.

On the implications for practice:
"Energy conservation has and will affect our profession. Until a few years ago we were concerned with budget, function, and aesthetics. In recent designs we are considering insulation and other energy conservers as well as passive and active solar. This has changed the form of our buildings. The largest impact will be the mandatory involvement of engineers in the design process." *Raymond Nadaskay, Nadaskay-Kopelson Architects, Morristown, N.J.*

"It is quite possible for a large A/E firm to have, in-house, those techniques and abilities to investigate performance standards as a project develops. This most likely would be feasible on large projects. The small firm, however, could probably not afford to offer this service as an on-going phase of its work. It is quite possible that on a small job, say less than $250,000, the consulting fee for engineering performance standards would be such a high percentage of the architectural fee as to make it unfeasible." *Norman L. Fenlason, Fenlason Associates, Tempe, Ariz.*



"The design professional should advise his client of the latest conservation techniques and should make his recommendations on incorporating these techniques and design approaches based on their efficiency, first cost, long-term cost, and their compatibility with the client's program." *Barrett & Associates, Atlanta.*

"The professional . . . holds the key to the success or failure of the conservation effort, for he holds at least an equal share of the knowledge in the field and he is the *only* person paid by the building owner to evaluate alternatives based on the total construction effort. I see the professional's duty as providing his client with all the information available about reasonable alternatives including initial and annual costs, with or without recommending a particular solution as the client may desire." *Glydewell Burdick Jr., Pace Engineering Inc., Minneapolis.*

"The effect that new energy policy will have on professional practice will eventually be reflected back to the consumer in the form of increased fees." *J. T. Burk, Charles Slater Architects Inc., Waukesha, Wisc.*

"It appears to us that energy conservation does not imply significantly increased costs, as many energy conservation strategies result in cost savings." *Geoffrey Harrison, Sims-Varner & Associates, Detroit.*

"Additional costs may slow down building somewhat, but over a period of time this rebellion against additional first costs will abate when owners are finally convinced of large long-term cost savings through lower energy consumption." *Donald R. Bray, Architectural Systems Coordinators Inc., Worcester, Mass.*

"All three design team members feel that for a passively designed residence, little if any increased costs would be entailed. No changes in traditional financing structures would be required. However, lenders need to be made aware of the potential of a passively designed home reflecting the environmental characteristics of the region and micro-climate rather than the traditional applied housing styles." *Chris Johnson, Architectural Alliance, Minneapolis.*

"Our particular building type was highrise apartment. I think it illustrated the importance of orientation, overhang, insulation, fenestration, and system approach. I did not feel comfortable with what current knowledge is with thermal storage effect, wind effects, and some of the less productive energy conservation areas. In our own building I believe we were able, by doing the 'conventional things,' to cut consumption of energy by 50 per cent." *Julian G. Olive, Thomas E. Olive Inc., Durham, N.C.*

On design and technical considerations:
"We think that it will be difficult to legislate a successful energy conservation program unless there is greater response from the public. Before initiating a national building code, we thing it is necessary to

stimulate manufacturing companies by introducing to them the concepts of our program so that they can realize the potential of expanding their product line." *Charles A. Dykins, Dykins Associates, Minneapolis.*

"A significant reduction in current energy use could be achieved *without regulations* if effective analytical procedures were made available at an affordable cost. Everyone favors energy conservation, but only a few of us know how to achieve the maximum reductions obtainable." *Charles H. Slater, Charles Slater Architects Inc., Waukesha, Wisc.*

"The little computer program available to us in Santa Monica, which allowed us to quickly evaluate the effect changes in mass had on our structure, probably was the most important factor in our solution. Had this program been available to us in the original design, we might have been able to clearly show our client at that time what saving he could achieve in the long run by relatively small increases in initial cost." *Donald V. Mussawir, Mussawir & Associates, Columbus, Ohio.*

"The energy conserving home tends to be a higher quality home. As money is spent on better materials less will be expended for the gimmicks or fads or styles which in the past have made the home part of our throw-away culture. The newer, higher quality homes may be a greater investment in a manner similar to the Europeans' concept of housing." *Chris Johnson, Architectural Alliance, Minneapolis.*

"I would like to say that the project pointed out to all designers who are real thinking people that energy conservation is not a constraint but a real task-master resulting in some very innovative designs. Many designs of buildings were actually improved in aesthetic appearance and function due to the consideration and studies that were made in behalf of energy conservation." *Raymond G. Alvine, Alvine Associates, Omaha.*

On performance standards:

"Being from Minnesota, where we have had ASHRAE 90-75 for several years, it was a real pleasure to switch over to a performance-based policy which gets down to real basics for an energy standard." *Frank L. Reese, Reese/ Rova Associates, Minneapolis.*

"As architects, we prefer the performance budget as a basis for energy policy. However, on the other hand, we can see that they are more difficult to monitor and probably will have little chance of success in the long run. An energy performance method such as ASHRAE 90-75 will be much easier to understand and to check." *Donovan D. Kramer, Durrant Architects Inc., Watertown, Wisc.*

"The project that we had completed was designed to the Minnesota Energy Code, which is basically ASHRAE 90-75, and we were able to save approximately one third energy cost beyond that." *Edward J. Kodet, Dickey/Kodet/Architects Inc., Minneapolis.*

"I think it is desirable to base energy design guidelines on a building's performance, rather than the performance of individual components. A holistic approach is always more accurate than a component approach." *S. R. Kenin, Solar Room Co., Taos, N.M.*

"A performance-based policy will . . . produce greater savings if our experience is common to the other projects. Through the redesign process we were able to reduce the overall energy requirements for our building by 43 per cent." *Alden C. Smith, Smith Architects Inc., Minneapolis.*

"I believe that if energy costs were allowed to rise to a higher level, we would see much more enthusiasm on the part of clients and professional designers for energy conservation. I suspect we're going to have to have two kinds of codes: prescriptive or 'cookbook' codes for less sophisticated designers and modest projects, and performance-based codes for use by more sophisticated designers and major projects. If energy costs are high enough, clients will seek out architects who know how to design truly energy efficient buildings." *Brian F. Larson, Larson, Hestekin, Smith, Ayres Ltd., Eau Claire, Wisc.*

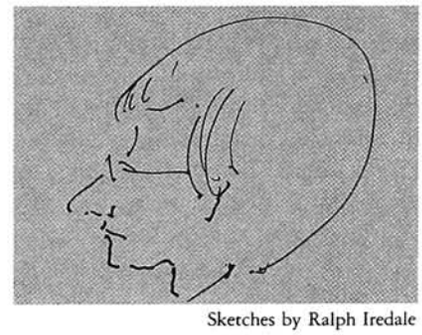
On educating architects:

"When we first received your proposal, I thought our involvement would be a picnic. It didn't take very long, however, to demonstrate how little I knew about passive energy design, and after many false starts and midnight hours, I feel that I now have a beginning understanding of the complexity of the problem." *Thomas E. Hanawalt, EMSA, Detroit.*

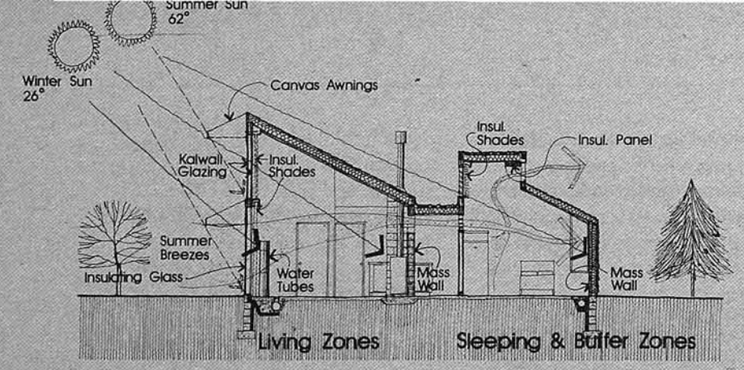
"The program also pointed out that there is much information that has been developed recently and that has not been taught in architectural schools in the past 15 to 20 years. The spread of energy conserving programs could be accelerated by developing continuing education programs for distribution at a low cost to the profession. It would appear that much of this work has been initiated in the Energy Inform notebook and in the project lectures." *Herbert C. Millkey Jr., Millkey & Brown Associates, Atlanta.*

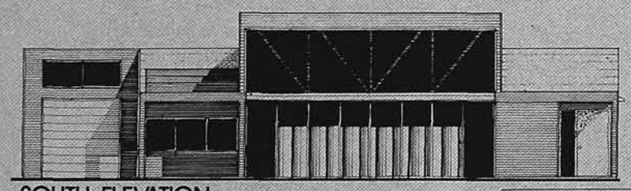
"Energy conservation should be at the heart of all design education courses." *Del Sessions, Donald E. Eby & Associates, Vancouver, Wash.*

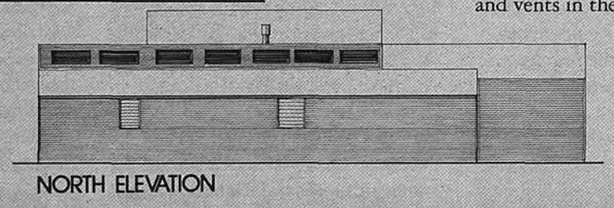
"I think it was Le Corbusier who said his secret was that he 'lived in the skin of a student.'" *Brian F. Larson, Larson, Hestekin, Smith, Ayres Ltd., Eau Claire, Wisc.*



Sketches by Ralph Iredale



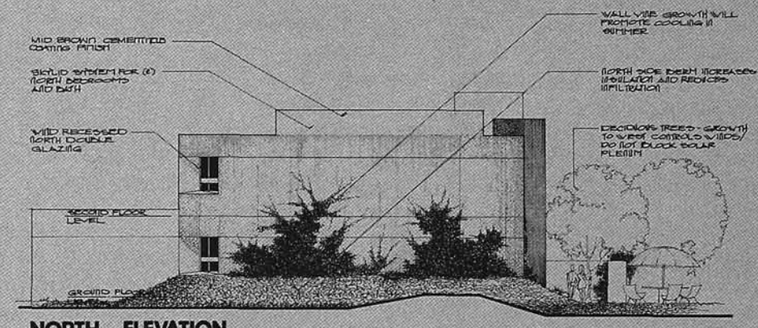


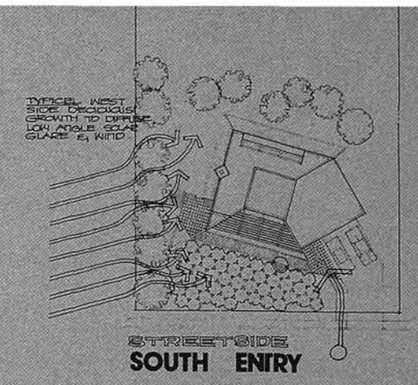


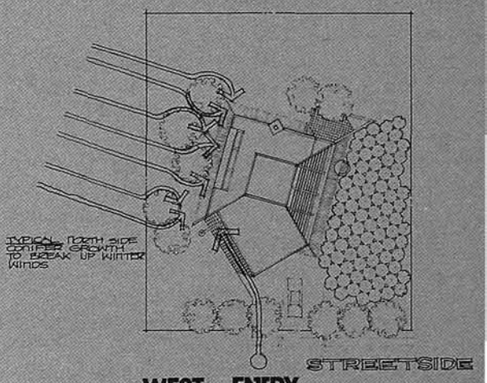
Residential designs for Omaha and Albuquerque

This one-story residence, designed for climatically-taxing Omaha by Clark Enerson Partners, is zoned to maximize passive heating and cooling. The living spaces open to the south, sleeping areas are to the north, and buffer zones face east and west. The south wall is glazed to a height of 16 feet and backed with water tubes for solar gain and storage. Interior massing—together with a north bedroom wall insolated through south-facing clerestories—adds to heat storage. For cooling, the house depends on natural ventilation through doors, windows, and vents in the north/south elevations.

Siting, direct solar gain, and heat storage are the keys to the passive design strategy for this two-story Albuquerque residence. Designed by architects Dean & Hunt Ltd. and Walker Brown Engineers, its square design and diagonal entry plan allow a southern orientation for the solarium on any site. South-facing skylids in the upstairs north bedrooms expose a northern mass wall to direct solar gain. Controllable louvers in the solarium provide direct gain to both a hollow-core water-tube storage wall and thermal massing in the floor and rear wall of the atrium. Air drawn through the water-wall and ducted to other rooms distributes heat throughout the house. For cooling, the high windows release warm air and increase natural convection, aiding the natural evening cooling of internal massing.







tice; more conservation even than that which might be expected to be realized by designing to today's existing standards. The savings are significant, more than 40 percent on the average.

Estimates of energy performance alone could, of course, not tell the whole story. Therefore, the project included a *qualitative* assessment of the state of the art of energy conserving design and its implications for policy and professional practice as represented by both the redesigns and the residential prototype designs. Both assessments offer a picture of how far along the learning curve American professional practitioners have come in energy-conserving design—information that will be crucial to HUD and DOE in developing energy budgets for new construction.

The assessors of the single-family residential prototypes agreed that almost all the design teams had underestimated the costs of their designs. There was also broad agreement that energy-conserving dwellings would cost more to build than the conventional home of comparable size.

A related economic concern had to do with the appearance of energy-conserving residential design. Would the look of a passive solar home, for example, turn off potential buyers? Homebuilders pointed out that consumers in the upper economic brackets will accept and be attracted to a nontraditional home; for them, something different means something special, and a solar home can be a symbol of status. However, for consumers on the middle and lower rungs, a traditional home is often important. The assessors felt that energy-conserving homes available in a range of styles, from the simplest tract house to the elaborate custom design, will do best in the homebuying market.

The assessors agreed that in order for energy performance standards to be realistic, practical, and intelligently applied, it is imperative that accurate estimating tools be developed. As it stands, estimating designed energy performance is not part of common practice. The task of modeling buildings and assessing their energy performance has been and continues to be an imperfect process.

The consensus at the residential assessment was that energy performance standards—if appropriately determined—will not impose life-style changes on the public. The clear implication is that users need information about energy conservation. They need to understand how their particular houses work, and how some of their actions may inadvertently inhibit energy savings inherent in design.

Based on their familiarity with the original commercial building concepts, the assessors of the commercial redesigns concluded that the redesigns demonstrate significant movement toward energy-conserving design among the nation's professional practitioners. At the same time, many of the redesign teams failed to take advantage of technology that is already available. When that technology was used, it was often poorly integrated into an otherwise effective energy-conserving strategy.

Moreover, few of the 168 design teams found reliable ways of calculating the full effect of their energy-conserving strategies. In respect to artificial lighting, for example, redesigners frequently achieved energy savings simply by reducing the number of lamps, without documenting their regard for the needs of the users or the activities being served.

Nor was much innovation evidenced in mechanical engineering solutions, perhaps because of the limited range of manufactured equipment that is available today.

There was widespread recognition of the need in energy-conserving design for a unified or holistic approach, with a building considered as a single energy-using system integrated with its environment, rather than a result of architects and engineers working at separate tasks. A unified approach would help ensure that energy-conserving opportunities and priorities be identified early in the design stage, so that qualitative aspects rarely addressed in the redesigns could be given due importance.

Those design efforts that did proceed holistically, and in which architects and engineers worked together, generally produced results that were more aesthetically interesting *and* energy-efficient. The implication is that practicing professionals need more education on energy-conserving concepts and more opportunities to analyze the outcomes together.

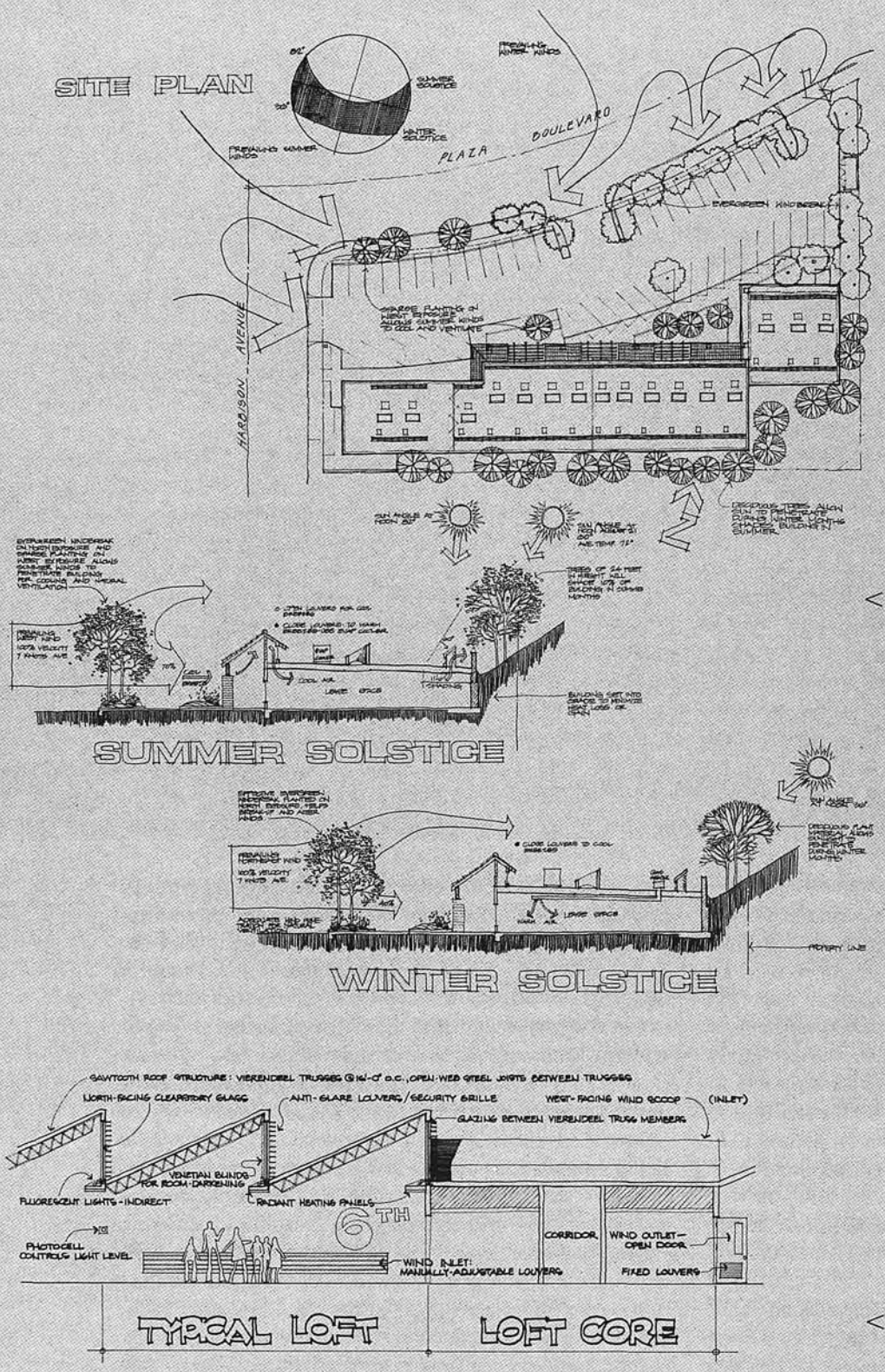
Though not enough attention was given to quality and little more to calculating the results of the design decisions that were made, the redesign process of Phase 2 marked an important step forward along the architectural learning curve, and indicated that American designers are capable of responding positively to available energy conservation information. Awareness of the participants had been heightened, and movement in the wake of the Santa Monica Energy Inform sessions was generally toward practicable energy-conserving design. Further, the prevailing feeling among the assessors was that design seems to be enhanced rather than hampered when form is more closely attuned to climate and energy requirements.

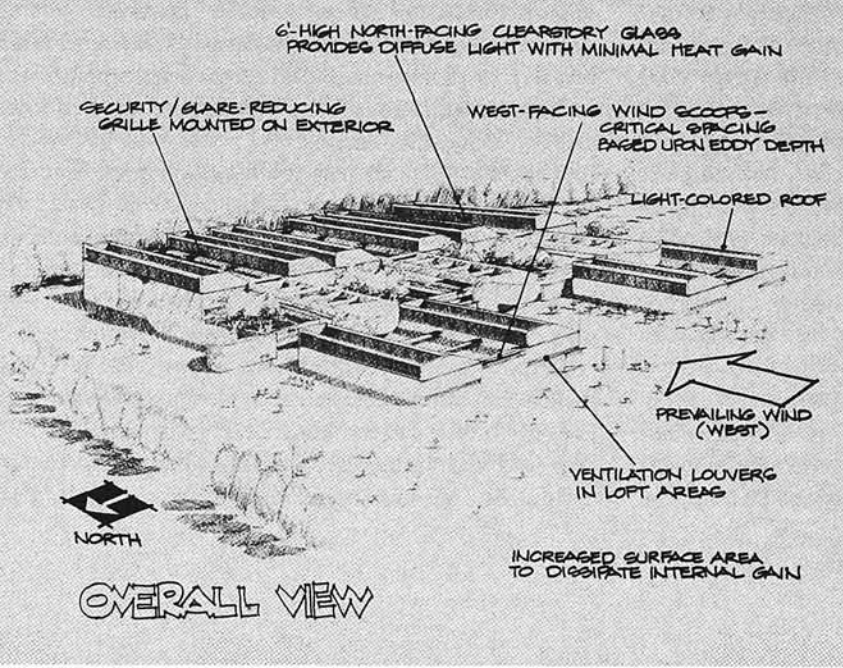
Shaping things to come

Where does the Baseline Project leave us? Certainly not with all the answers. The research did generate the numbers required by HUD and DOE. But in the process, the research revealed difficulties in the building and climatic classification systems which were used. The research revealed too that computer modeling has some distance to go before it realizes fully its potential as a useful tool for designers.

But, while recognizing that design research is constantly being modified and refined to reflect new information as well as such new concerns as energy conscious design, the Baseline Project has already come up with information that has design, professional, and public policy implications that cannot be ignored. For one, the Phase 2 research shows that significant energy savings—on the order of 40 per cent for commercial buildings—are entirely possible with today's design technology. Also, Baseline's comparisons of estimated energy consumption—in original buildings, in the same buildings redesigned to existing performance standards, and in the same buildings redesigned to state-of-the-art levels—calls into serious question the technical effectiveness of today's component performance standards. The same research reveals that professionals need more useable quantification techniques, techniques which go beyond the performance standards question entirely.

The more general and challenging conclusion is that energy conservation is not a constraint, but is in fact a design opportunity. That an energy ethic can evolve into an exciting new aesthetic was repeated over and over again by both the designers who participated in Baseline's research and the assessors who reviewed their commercial redesigns and residential prototypes. What Baseline makes clear is that designers can have a significant impact not only on the shape of future energy performance standards and the immediate concerns of energy conscious design, but on new shapes for architecture itself.



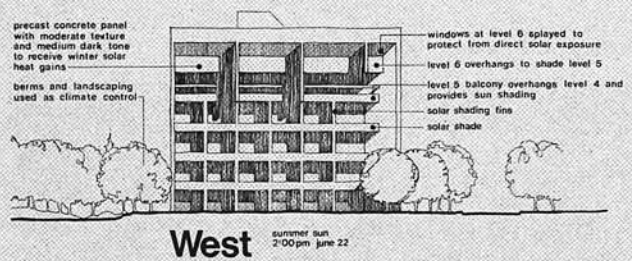


Redesigns: A school, a shopping center, an office, and a dormitory

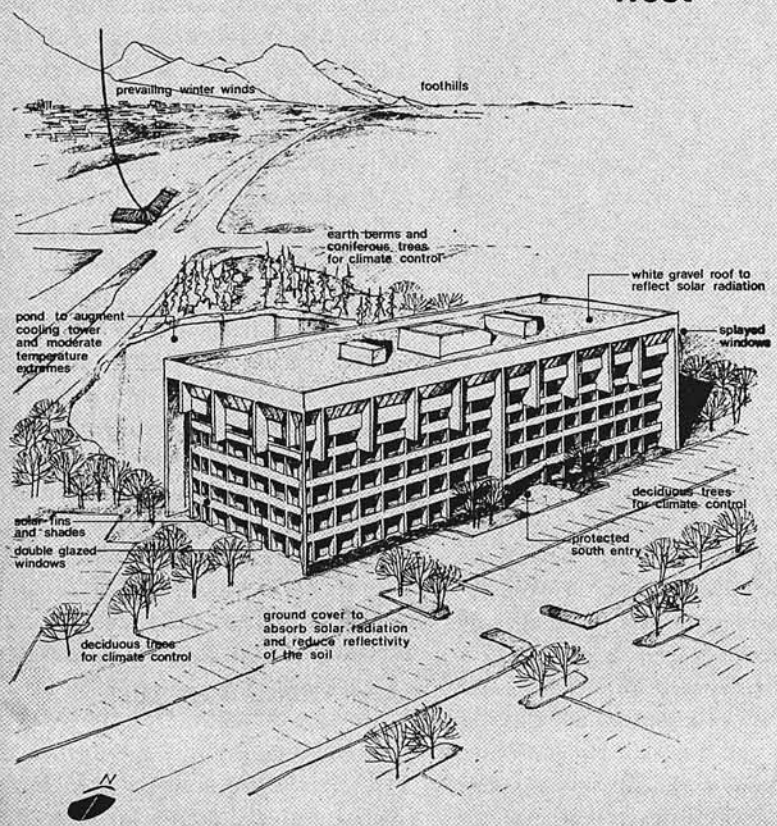
Architects Drake, Sillman & Wyman and engineer William Herries redesigned this small shopping center south of San Diego using natural ventilation and solar control as their key energy conservation strategies. Natural light enters through photocell-controlled skylights, windows, and clerestories. Switch- or breaker-controlled indirect fluorescent fixtures provide artificial light. Careful venting and landscaping answer the building's cooling needs, aided by rooftop evaporative coolers during the peak cooling season. Deciduous planting and a gas warm-air furnace handle winter heating requirements.

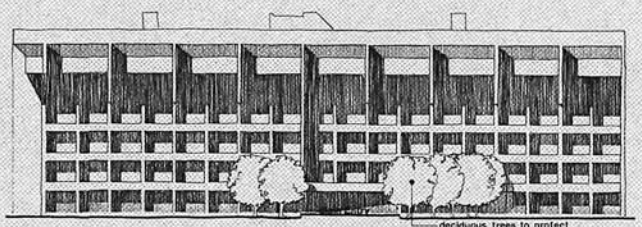
This six-story Colorado office building, redesigned by architects Brooks Waldman Associates and engineers Beckett, Harmon, Carrier & Day Inc., is an exercise in screening. Fins, sunshades, and an overhanging top floor control daylight penetration on the southeastern and southwestern facades. Berming, planting, and a completely different treatment for the northeastern facade screen the building from winter winds. Rheostated incandescent and two-lamp parabolic fluorescent fixtures illuminate the interior, the latter controlled by photocells, computers, and switches.

This San Diego elementary school redesign also took advantage of prevailing breezes to reduce—and in this case eliminate—dependence on mechanical cooling systems. West-facing windscoops and ventilation louvers in loft areas create natural circulation. Form was altered to increase surface area for dissipation of internally-generated heat. Tall, north-facing clerestories provide diffuse natural light with minimal heat gain. To meet the building's minor winter heating needs, architects Deems, Lewis Partners and LSWB & MacDonald Engineering included ceiling-mounted radiant heating panels and a southeastern "thermal window" that is shaded in spring and summer.

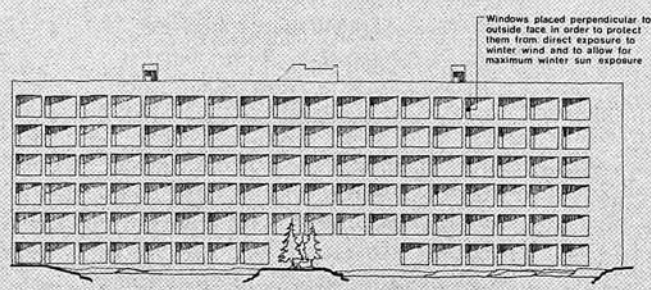


West summer sun 2:00pm june 22



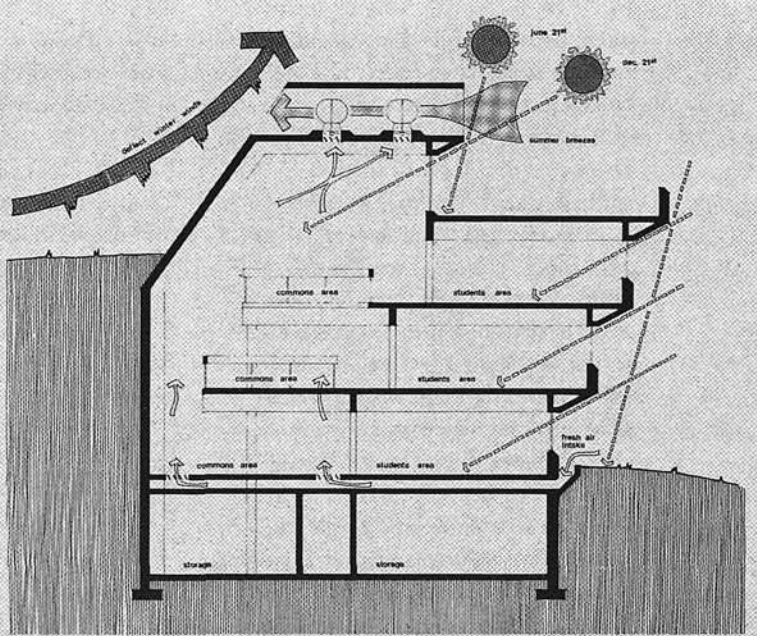


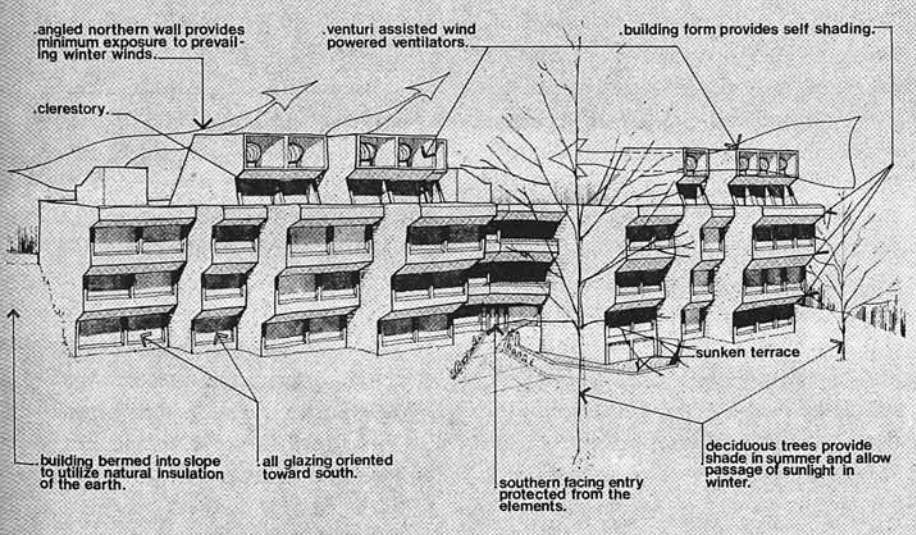
South summer sun 2:00pm june 22



North summer sun 4:00 PM june 22

A complete change in building form marked this redesign of a dormitory for secondary students on the Gallaudet College campus in Washington, D.C. Buried into a north slope to minimize the area's wide temperature swings, the building uses photocell-controlled southern glazing for winter heat gain and deciduous planting for summer shade. Gravity-assisted ventilators facilitate natural cooling and help to dispel the region's notoriously high humidity. HTB Inc. redesigned.





ABSTRACTS

The following abstracts of recent architectural research are drawn from the AIA Research Corporation's Research Information Retrieval System (RIRS), an architectural data bank containing information on research projects and reports touching on every aspect of architectural practice.

The RIRS system exists to be used by practitioners in need of current and often specialized information. Only recently developed by AIA/RC, the system is accessed through a keyword list, and its resources are available for quick retrieval upon request. References are being added—and the keyword list expanded—almost daily.

In addition to drawing abstracts, reports, and publications from RIRS, practitioners are also encouraged to contribute to the system. If you or your firm have recently completed work that may advance the expertise of the profession as the work detailed here and elsewhere in this issue of *Research & Design* has, you are invited to summarize and submit it for inclusion in the RIRS system.

All submissions, requests, and other inquiries should be addressed to Abstracts, AIA Research Corporation, 1735 New York Avenue, N.W., Washington, D.C. 20006. Tel. 202/785-7843.

1978 Directory of Construction Associations

The 1978 Directory of Construction Associations is a single-volume source of information concerning construction industry organizations—including technical, professional, trade, business, manufacturing, and government groups. Its primary value is in providing users needful of information on specific subjects relating to construction with a means of quickly locating and contacting highly qualified sources in the construction industry.

RIRS# 780720

This abstract refers to **1978 Directory of Construction Associations** by Professional Publications; 1978.

This publication can be ordered from: Professional Publications, P.O. Box 319, Huntington, N.Y. 11743. Price is $11.95.

Building Loads Analysis and Systems Thermodynamics Program

The Building Loads Analysis and Systems Thermodynamics (BLAST) program is a comprehensive set of subprograms for predicting energy consumption in buildings. Three major subprograms include (1) the spaceload predicting subprogram, which computes hourly spaceloads in a building or zone, based on user input and hourly weather data; (2) the air-distribution system subprogram, which uses the computed spaceload and user inputs describing the building air-handling system to calculate hot water or steam, chilled water, and electric energy demands, and (3) the central plant simulation program, which simulates boilers, chillers, on-site power-generating equipment, and solar energy systems, and computes monthly and annual fuel and electrical power consumption to plant life-cycle cost. The program is written in Control Data Corporation (CDC) FORTRAN Extended, Version 4, and can be used on CDC 6000/7000 series computers with few modifications.

RIRS# 780810

This abstract refers to **The Building Loads Analysis and Systems Thermodynamics Program** by D. C. Hittle; December, 1977.

This publication can be ordered from: National Technical Information Service, Springfield, Va. 22161, for $8.00. Ask for CERL Technical Report ADA 048 734.

Residential Electric and Gas Water Heaters

This report provides performance data for electric and gas-fired residential water heaters. Performance characteristics investigated include unit full-load, part-load, and overall efficiencies, and detailed examination of standby losses. Also included are brief discussions of energy-conserving options, such as lowering thermostat settings, increasing insulation thickness, and reducing pilot rate.

RIRS# 780645

This abstract refers to **Residential Electric and Gas Water Heaters** by Ebrahim Farahan; August, 1977.

This publication can be ordered from: National Technical Information Service, Springfield, Va. 22161, for $4.50. Stock #ANL/CES/TE 77-2.

Office Programming Guidelines

When an architectural programmer or a management analyst begins to investigate an organization, how does he or she go by about organizing information on workers, job descriptions, workflow, visitors, management procedures, formal hierarchy, informal flow of communications, room numbers, etc.? This re-

port describes one way to go about such a task. It may surprise those who are familiar with R. G. Barker's Behavior Setting Theory (1968) that only the first part of his Behavior Setting Survey—the K-21 test for identifying behavior settings—is used. The K-21 test is traditionally used only as a procedural step in the survey, and not as an end in itself. But when the design or reorganization of an office environment is being programmed, the K-21 test results, by themselves, can provide valuable information. This information results in improved design of Army facilities, more cost effective solutions and greater efficiency of operation. The recommendations for changes developed in this study are primarily based upon the K-21 test scores.

RIRS# 780656

This abstract refers to **Guidelines for Architectural Programming of Office Settings** by C. Burgess Ledbetter; March, 1977.

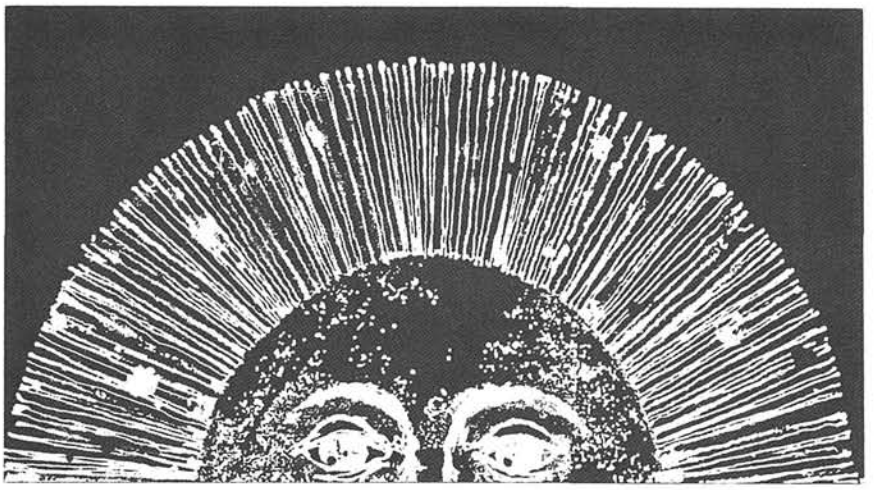
This publication can be ordered from: National Technical Information Service, Springfield, Va. 22151, for $4.00. Stock #AD-A037-125.

Windows and Design

Recent design recommendations have called for reduced window area in buildings to conserve energy. This report presents new information on thermal loads, daylighting, management, and life-cycle costs which indicates that such recommendations may neglect important design and operational aspects of windows which can conserve energy resources and reduce life-cycle building costs. A case example is described in which energy consumption and life-cycle costs are given for windows in a typical house in the Washington, D.C. area. Noticeable reductions in overall energy consumption and life-cycle costs are found if daylight is used, and if the window is managed. It is suggested that builders and lending institutions consider the long-term effects of window design and operation decisions.

RIRS# 780711

This abstract refers to **A New Look at Windows** by Collins, Ruegg, Chapman, and Kusuda; Jan., 1978.



This publication can be ordered from: National Technical Information Service, Springfield, Va. 22151, for $4.50. Stock #NBSIR 77-1388.

Solar Resources

The Citizens' Energy Project has put together this list of information on solar energy grant sources, legislation, technology, citizen groups, manufacturers, etc., that should be of interest to architects and engineers. This list, which is in newsletter format, names each citizens' organization, its address, and the resources it has available.

RIRS# 780697

This abstract refers to **Solar Energy Resources** by Citizens' Energy Project; 1978.

This publication can be ordered from: Citizens' Energy Project, 1413 K Street, N.W., 8th Floor, Washington, D.C., 20005. No charge for limited copies.

Hybrid Solar Energy Systems

Heating and cooling systems that use hybrid solar energy collectors (combination photovoltaic/thermal) have the potential for considerable energy savings, particularly when the system includes a heat pump. Economic evaluations show that photovoltaic systems are potentially most economical, but results depend critically on future collector costs as well as energy prices. Results are based on a specially developed computer program that predicted the total auxiliary energy required for five different solar heating/cooling systems. Performance calculations for a modeled residence and small office building were made using meteorological data from four geographic locations. Annual system costs were also calculated.

RIRS# 780733

This abstract refers to **Hybrid Photovoltaic/Thermal Solar Energy Systems** by Edward C. Kern Jr. and Miles C. Russell; March, 1978.

This publication can be ordered from: AIA/RC, 1735 New York Ave., N.W., Washington, D.C. 20006. No charge.

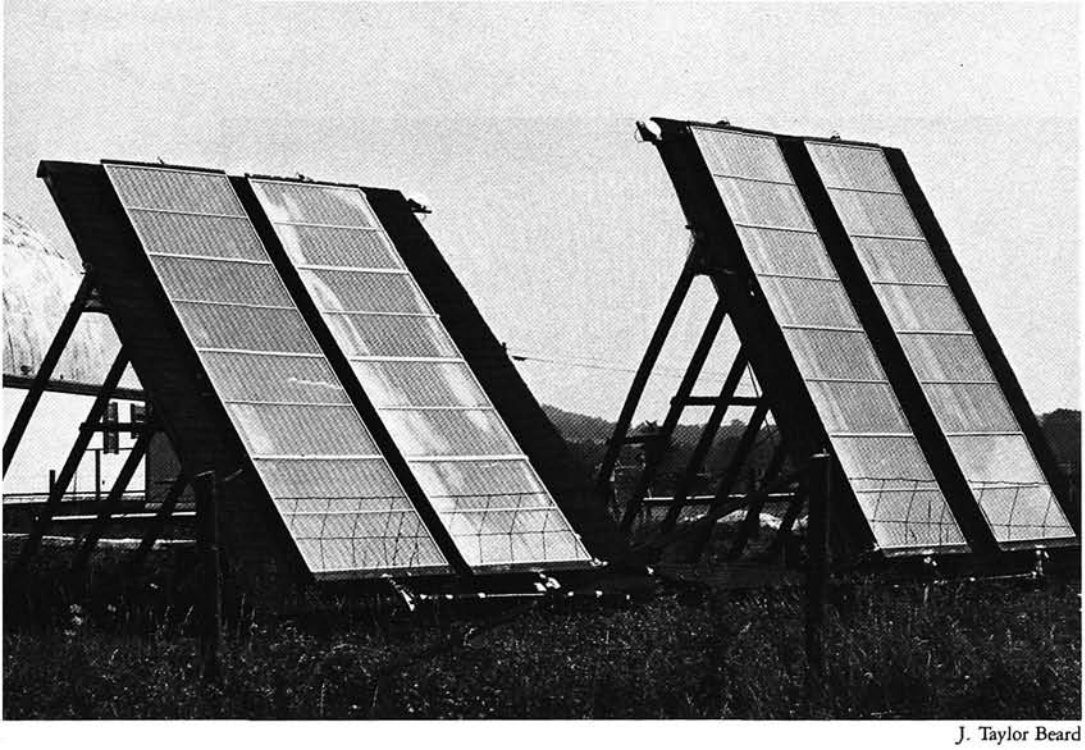
Solar Heating and Cooling Demonstration Project Summaries

The Department of Energy's Solar Heating and Cooling Demonstration program includes commercial and residential buildings sponsored by DOE alone, or jointly with other Federal agencies, city and state governments, and private agencies. The commercial projects include a wide variety of building types, including office buildings, schools, fire stations, civic centers, factories, and libraries. Residential projects include both single and multifamily dwellings of various configurations.

Approximately 200 of the projects will be instrumented to measure the performance of their solar systems. Analysis of the collected data will provide definitive guides for design criteria and permit realistic economic assessment of various solar systems.

The demonstrations are discussed here in four sections, which include commercial and residential nonfederal and federal buildings.

Maps showing the locations (by



J. Taylor Beard

Solaris solar collectors on a test stand at the University of Virginia's research facility in Charlottesville.

state) of the buildings are provided at the beginning of each section, along with an index which identifies each project and page number for the corresponding descriptive information. A map depicting the distribution of all demonstration projects is included in this introduction. The comparable map from last year's publication is also shown to depict the increase in the number of projects. The contents of this document are based on information available as of Nov. 1, 1977.

RIRS #780710

This abstract refers to **Solar Heating and Cooling Demonstration Project Summaries** by the U.S. Department of Energy; May, 1978.

This publication can be ordered from: Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $4.50. Stock #061-000-00082-8.

Solar Space Heating Systems Using Annual Heat Storage

The development of practical design methods and the evaluation of observed performance data from instrumented annual storage systems is reported. The application of new analysis and survey work to engineering design is presented. A previously developed computer simulation is extended to derive new methods of determining cost-optimal annual storage systems operating under specified conditions. The development of new methods of analysis of the behavior of soil heat flow and solar collector models is reported.

RIRS# 780730

This abstract refers to **Solar Space Heating Systems Using Annual Heat Storage** by Hooper, Attwater, Brunger, Cook, and McClenahan; February, 1978.

This publication can be ordered from: National Technical Information Service, Springfield, Va. 22161, for $7.25. Stock #COO/2939-5.

Collector Analysis and Testing

An outdoor solar collector testing facility was built at the University of Virginia for the purpose of conducting thermal performance evaluations of the Thomason "Solaris" water-trickle solar collector. The facility was used for simultaneously testing four "Solaris" collector panels under different operational conditions of inlet water temperatures and flow rates with the same atmospheric exposure.

The performance of the "Soaris" water-trickle collector is compared with published results for conventional single and double glazed flat-plate collectors.

A theoretical model of the collector has also been used to examine thermal performance. The model and experimental measurements were used to determine the sensitivity of the collector's performance to such variables as ambient temperature and wind—the two major variables which influence collector performance.

Experimental measurements and the model also were used to demonstrate how design changes, such as glazing spacing, glazing material, double glazing, and condensate suppression influence the performance of the water-trickle collector. Various glazing materials and double glazing were found to greatly change the collector's performance.

The test facility was expanded to evaluate the performance of an open fluid-film (silicone oil) collector designed by Scientific-Atlanta Inc. Testing was done at various ambient conditions and a discussion of the results are presented.

RIRS# 780731

This abstract refers to **Engineering Analysis and Testing of Water-Trickle Solar Collector** by J. Taylor Beard; November, 1977.

This publication can be ordered from: National Technical Information Service, Springfield, Va. 22161, for $5.25. Stock #ORO/4927-78/1.

Characterizing Adobe Building Materials

The complete physical and mineralogical characterization of soils is a lengthy process because soils consist of a complex mixture of different mineral and organic substances. However, by considering only the most important properties affecting the performance of a soil used as an adobe building material, the analysis is simplified. Methods are described for the characterization of those physical properties and mineralogical features of adobe which appear to have the most significant affect on the durability of adobe. These methods include measuring those properties of adobes which appear to have the most significant impact on their durability, such as particle size distribution, chemical and phase com-

positions, and the response of adobes to moisture. In addition, methods are provided for the rapid comparison of the properties of repair materials with those of the original adobe.

RIRS# 780734
This abstract refers to **Methods For Characterizing Adobe Building Materials** by J. Clifton, P. W. Brown, and C. R. Robbins; June, 1978.

This publication can be ordered from: Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $2.30. Stock #003-003-01940-2.

Selection, Production, Procurement and Use of Preservative-Treated Wood

The economical and practical procurement of treated wood demands a knowledge of wood deterioration and means of protection. The U.S. Forest Products Laboratory, the nation's center for wood utilization research, has studied preservatives and their effects on wood for nearly three-quarters of a century. This report has been compiled to assist in the selection and procurement of treated wood products. It elucidates the technical details of the specifications—the causes of wood deterioration, the nature and variety of preservatives, the advantages and disadvantages of different types of preservatives, and preservative treatment procedures for all uses and situations.

RIRS# 780673
This abstract refers to **Selection, Production, Procurement and Use of Preservative-Treated Wood** by Lee Gjovik and Roy Baechler; 1977.

This publication can be ordered from: U.S. Dept. of Agriculture, Forest Service, Forest Products Laboratory, Madison, Wis. 53705. No charge.

Predicting Racking Strength

Horizontal forces, such as wind, are resisted by the walls parallel to the wind direction. These forces, which lie in the plane of the wall, are known as shear or racking loads, and are transmitted to the sheathing through the fastener system. Qualification of sheathing materials has generally been limited to performance testing of 8- by 8-foot (2.4- by 2.4-m) stud wall assemblies. An analytical procedure has been developed that accurately predicts racking strength based upon the lateral resistance of the individual fasteners. The structural model is applicable to any sheathing size or geometry, so it is possible to determine the racking strength of light frame walls from simple lateral nail tests or small scale racking tests. The procedure offers a direct means for designers and code officials to predict racking strengths of panels incorporating various sheathing materials and fasteners.

RIRS# 780681
This abstract refers to **Predicting Racking Strength of Light-Frame Walls** by Roger Tuomi and William McCutcheon; October, 1977.

This publication can be ordered from: U.S. Dept. of Agriculture, Forest Service, Forest Products Laboratory, Madison, Wis. 53705. No charge.

Holes in Plywood Beams and Glued Laminated Timber Beams

This report contains brief descriptions of research work concerning the effect of large holes on the load-carrying of plywood I-beams and glued laminated timber beams. A lot of strain measurements were made at the holes for comparison with strains calculated mainly by means of a finite element method (FEM). The beam failure loads were predicted using the calculated stresses and some failure criteria. The elastic properties and strength properties for the beam materials were found from minor tests.

The research work was carried out at the Chalmers University in Sweden over the last three years. This report is a survey of five reports that have been written in the course of the work.

RIRS #780633
This abstract refers to **Holes in Plywood Beams and Glued Laminated Timber Beams** by Bengt Johannesson; December, 1977.

This publication can be ordered from: Chalmers Tekniska Hogskola, Institute for Stal-och Trabyggnad, Fack, S-401 20 Goteborg, Sweden. Ask for publication S77:4.

Noise Criteria For Buildings

A review is given of existing criteria that could be applied to rating the noise environment in dwellings, to rating noise isolation between dwellings, and to rating noise isolation from outside to inside a dwelling. It is concluded that the central problem is to select appropriate criteria for rating the interior noise environment. Once this is done, criteria for noise isolation can be derived directly and then in turn can be used to derive performance requirements for building elements, such as partitions and exterior walls.

RIRS #780334
This abstract refers to **Noise Criteria for Buildings: A Critical Review** by Simone L. Yaniv and Daniel R. Flynn; January, 1978.

The publication can be ordered from: Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price is $2.40. Stock #003-003-01870-8.

Asbestos Hazards

Asbestos has become a widely used material in our industrial society over the last 100 years. Unfortunately, there are grave hazards attendant upon its use. The purpose of this report is to stimulate a greater awareness of asbestos hazards, and generate actions which will reduce and eliminate these hazards. In almost all cases, the hazards can either be eliminated by substitution of less dangerous materials or reduced by implementing safer working conditions and practices.

RIRS# 780672
This abstract refers to **Asbestos and You** by Barry Castleman and Albert Fritsch; 1975.

This publication can be ordered from: Citizens' Energy Project, 1413 K Street, N.W. 8th Floor, Washington, D.C. 20005, for $4.00.

THE MARKETPLACE

Profile:

The Department of Housing and Urban Development's Office of Policy Development and Research

On July 20, 1892, Congress directed the Bureau of Labor (then part of the Interior Department) to conduct a special investigation of slum conditions in U.S. cities with populations over 200,000. That investigation revealed serious housing problems in four of the 16 qualifying cities. It also revealed a statistical correlation between the occurrence of blighted areas and the frequency of saloons. Seventy-three years later the Department of Housing and Urban Development (HUD) was created to deal with the situation, giving Cabinet-level recognition to a national problem that by 1966 included over 9 million substandard housing units, most of them in cities and almost half of them without running water.

As part of President Lyndon Johnson's call for a Great Society, HUD was created to mount a frontal assault on those statistics, and to bring under one roof such diverse existing housing programs as the Federal Housing Administration and the Federal National Mortgage Association. Today, with a FY 1978 budget in excess of $10.5 billion and a projected 1979 staff of 17,400, HUD's policies affect the design, construction, or sale of virtually every residential unit in the country. And, in the wake of President Carter's new National Urban Policy, announced last March, HUD has requested a total FY 1979 budget of $11.2 billion, and is gearing up for appreciably greater efforts to revitalize the urban environment.

As with any large policy-making organization, HUD needs timely, balanced, and broadly conceived research information to ensure that its programs respond to real needs, and with effective solutions. This requirement is met by the work that goes on under the direction of HUD's assistant secretary for Policy Development and Research (PD&R), Dr. Donna E. Shalala. A specialist in state and urban finance and government from Columbia University's Teachers College, Shalala presides over an administrative and research staff of 227 and a budget currently over $61 million. PD&R's primary units are an Office of Research under

Raymond J. Struyk (author of several books and articles, including the 1976 Urban Institute report *Urban Ownership: The Economic Determinants*), an Office of Policy Development under David F. Garrison, and an Office of Economic Affairs under Katharine C. Lyall.

Struyk's Office of Research—particularly its Energy, Building Technology and Standards Division and Community Conservation Division—will be of most interest to architects. The Energy, Building Technology and Standards Division led by Joseph Sherman (202/755-6443) supports research on subjects ranging from the fire resistance of building materials and earthquake-damage mitigation to mobile home design and energy performance standards for the design of new buildings (discussed in the cover article of this issue). The Community Conservation Research Division, temporarily under the guidance of Howard J. Sumka (202/755-7336), is concerned with the revitalization of both the commercial and residential segments of neighborhoods, as well as with design standards for urban parks, residential security systems, and access for the handicapped.

Shalala emphasizes that HUD's Policy Development and Research unit is above all a "service organization"—and this means service to the offices of HUD's other assistant secretaries. At the beginning of HUD's yearly budget cycle PD&R tries to discover, for example, what Assistant Secretary for Community Planning and Development Robert C. Embry's office needs to know in order to make rational program plans for upcoming budget requests. Having accumulated a list of need-to-know issues—sometimes quite diverse and extensive—from the offices of the other assistant secretaries and such agencies as the Federal Home Loan Bank Board and the Farmers Home Administration, PD&R defines research priorities and develops specific research projects aimed at answering the most pressing questions. One non-HUD federal official put it this way: "The assumption is that they—the other assistant secretaries—know what the problems are, and that PD&R knows how to do research."

For example: HUD's huge ($3.75 billion for FY 1979) Community Development Block Grant program, administered from Embry's office, is undergoing a $4 million evaluation by the University of Pennsylvania under a grant from PD&R's Evaluation Division, headed by Frederick J. Eggers (202/755-6230). Key motivation for the evaluation are questions about whether spot or concentrated redevelopment efforts are more effective, and whether the greater leeway permitted local governments in 1974 in dispensing redevelopment funds was used to bene-

fit low- and moderate-income persons. While the bulk of the researchers' tasks are oriented toward the demographic and economic changes brought on by redevelopment, the evaluation will focus also on "housing quality and neighborhood conditions." Initial findings of the study—which should be of interest to architects engaged in public housing design, research, and evaluation—are scheduled to be available in mid-1979. The project is slated to continue for four years.

A second ongoing evaluation focuses on HUD's "Section 8" housing assistance program. The department's largest assistance effort, the Section 8 program provides funds to local government agencies, which contract with private landlords to provide standard housing units for low-income households. The PD&R evaluation, under Jerry J. Fitts' Housing Research Division (202/755-5900), will look into Section 8 impacts in rural areas and the cost and management of new or substantially renovated buildings funded under the program.

This "go-where-the-problems-are" approach to research constrasts with a notion of research that is essentially exploratory and anticipatory, found frequently in "think tanks" and university research institutes. HUD seems to feel that sort of research is best left to agencies such as the National Science Foundation, and to private outfits. PD&R's service approach is consistent with Shalala's view that PD&R resources must not be diverted to research that, although intrinsically valuable, "only dilutes what can be done in the consensus areas of highest need." As it is, 60 per cent of PD&R's budget is already obligated to such long-term or recurring research efforts as the extensive Annual Housing Surveys and support of quasi-governmental groups like the Urban Reinvestment Task Force (*Research & Design,* Vol. I, No. 3).

Shalala is also making an effort to alter the mix of PD&R's research resources. During HUD's early years neither HUD nor anyone else had the research expertise in urban affairs necessary for the development of effective policies. In 1968 the Urban Institute was created as a private, nonprofit corporation to fill this need, nurtured by HUD in much the same way that the Air Force sponsored the birth and early work of the Rand Corporation following World War II. Since the Urban Institute's creation, of course, the field has expanded considerably, and PD&R is in the process of inviting other urban research groups to join the Urban Institute in competitive bidding to provide research in their areas of special competence. At the same time, PD&R has taken steps to strengthen its in-house research capabilities, both through the addition of high-level researchers to its permanent staff and by the initiation of a visiting scholars program within PD&R—what Shalala calls an "urban Fulbright" program (see "Prospects," *Research & Design,* Vol. I, No. 2).

Research based outside PD&R will continue, however, to be the foundation of PD&R's work. "It is seriously misleading," Shalala says, "to think that urban solutions are one-shot deals. We are dealing with organic matters." It is "absurd," she says, "to think that the direction research takes must shift each time a new administration takes over." She hopes that the necessary continuity will come from nonprofit, university-based groups, with other private groups receiving a correspondingly lower number of research contracts.

Jeffrey Boyd Beard

The President's National Urban Policy has been criticized as a dizzying array of programs scattered throughout the federal bureaucracy. HUD apparently sees this as a plus.

Congress is now debating what to do about the legislative segments of the National Urban Policy (NUP) unveiled by President Carter last March. A collection of nine policies to be implemented by 56 new or redirected programs, NUP has been criticized as a dizzying array of programs scattered throughout the federal bureaucracy. HUD apparently sees this as a plus—an overdue recognition that seemingly unrelated programs can have enormous impacts on urban communities. Indeed, one of the 56 programs centers on a new requirement that "Urban and Community Impact Analyses" be made of all proposals for major federal policies or program initiatives. An Office of Management and Budget (OMB) circular issued in August directs that the impact analyses be a part of each agency's regular budgetary and legislative submissions to OMB. Impacts to be considered include those on employment, the availability and quality of housing and public services, and neighborhood stability. Unlike their older brothers, the environmental impact statements, the urban impact statements are required for each program but *not* for individual projects carried out under a program.

"We're trying to get policy makers to hesitate, to add another dimension to their decision-making process," Shalala explains. "We don't want to immobilize them, but we do want to sensitize them." So far, HUD itself has been the most active practitioner of the new analyses. Shalala's PD&R staff has completed over 30 on HUD's FY 1979 budget proposals, and is looking now at other agencies' programs, including the Carter Administration's proposals for welfare reform.

Later this fall HUD expects Congressional authorization for a $5 million Livable Cities program—also part of NUP—to help local communities develop and preserve their artistic, cultural and historic resources. The program is an outgrowth of the National Endowment

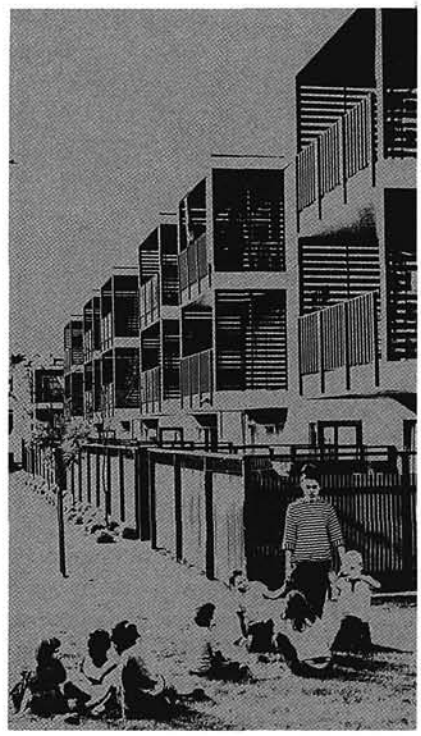
for the Arts' program of the same name. But unlike the Endowment's program, which concentrates on high-quality design, HUD's program will fund a broad range of strategies, including but not limited to design. Regulations governing the HUD program will be developed jointly by HUD and the Endowment. The program will distinguish itself from many previous HUD programs by providing grants directly to community groups, voluntary associations, and other nongovernmental entities.

"The jury is still out" on the expansion of work at PD&R in environmental design research, says Don Geis of the Community Conservation Division's branch (202/755-6450). Geis and colleague Sam Hodges, who together constitute the division's design branch, point to numerous publications already produced by their office, though, including *Solar Dwelling Design Concepts* (prepared by the AIA Research Corp.), *A Handbook for Pedestrian Action, The Rediscovery of the Pedestrian, American Urban Malls: A Compendium,* and a site plan evaluation guide for housing.

Other design work includes defensible-space guidelines prepared for HUD by the National Bureau of Standards. At the Bureau's Center for Building Technology visitors can see a slide show on how doors in a test-stand are battered by the shoes of the "standard thief." PD&R has sponsored work on street graphics, produced a yet-to-be-published post-occupancy evaluation study, plus a look back to Great Society days in an evaluative report entitled *Operation Breakthrough: Site Planning and Design.*

PD&R has also supported research by Harvard professor John Zeisel on design-related social and psychological issues in low-rise housing for the elderly. Other disability-oriented design work has included design modifications—including fire safety—needed to make mobile homes a successful source of independent living for the handicapped, and design, managerial, financial, and social issues in the integration of the handicapped in HUD-supported housing.

PD&R's research dissemination efforts have gone multi-media with films on site design and residential security technical assistance. Architects who work with developers may be interested in a PD&R-funded handbook from the Community Association Institute on the developer's role in getting community and condominium associations off the ground.



Today, HUD's policies affect the design, construction, or sale of virtually every residential unit in the nation. And it's gearing up for appreciably greater efforts.

Why, after all this design-oriented work, is the jury still out at PD&R on a continuing, adequately funded design research office? Part of the answer has to do with what has admittedly been a "shotgun" approach to design research. Design work hasn't had the ongoing character of such other PD&R research work as that on energy conservation and lead-based paint hazards. Instead it has produced scattered reports on security, disaster, and special-user design. Another reason for the uncertainty, according to Geis, is that designers have a difficult time proving the practicality of their efforts. While it's fairly easy to see the importance of design elements of such specific issues as access for the handicapped and mobile home safety, it's harder in the bulk of HUD-sponsored housing, where traditional design seems *prima facie* to meet reasonable criteria for "decent housing." There, the emphasis is understandably on housing availability and the financial levers that make that availability possible. So housing design qualities have taken a back seat to manipulation of market forces and the development of appropriate regulations. The result—except in the energy area—is that in requesting research from PD&R, the other assistant secretaries have yet to find the vocabulary of design a convenient vehicle for the expression of their needs. Naturally, many of those concerned with design research feel that to emphasize economics is to emphasize the "how" of the quality of life in the built environment at the expense of the "what."

Another more nebulous but very real issue in making design research practical concerns the appropriate scale of such work. Design research at HUD so far has been on many different scales—from individual building components to citywide planning for pedestrians. In the community design branch, a consensus seems to be growing that the neighborhood—as opposed to the individual building or the metropolis—is the most effective unit on which to concentrate research, demonstration, and design efforts. The neighborhood, it is believed, is the "ekistic unit" in which the majority of human activities take place. It can contain multi-use facilities and a variety of people; yet it is small enough to respond fairly quickly to planning and design efforts—and, through neighborhood organizations, to financial leverage. To see if the concept is workable, PD&R's Community Conservation Research Division is now circulating a draft of issues for a proposed Neighborhood Design Conference and Workshop to be held early in 1979. Interested researchers might contact Hodges in the next few months to keep track of the conference's fate.

—Evan M. Dudik

Grantsmanship

In its cover article on *Godfather* author Mario Puzo last August, Time Magazine quoted John Steinbeck thus: "The profession of book writing makes horseracing seem like a solid, stable business."

While some inveterate gamblers —not to mention punsters—might question Steinbeck's claim, experienced makers of unsolicited research proposals know that their profession easily ranks in riskiness with writing and riding. One university proposal writer puts the chances of striking out at nine out of ten.

Such statistics, which are more valuable as rhetorical reminders to be realistic in assessing your proposal's prospects than for measuring its actual chances, apply most of all to *unsolicited* research proposals. Depending on the competition and whether you have a corner on a particular part of the research market, you can improve your chances by turning out a well-crafted response to a Request for Proposals—especially if you have advance word of impending publication of the RFP.

Grants for unsolicited research may soon be easier to obtain for profit-making architectural firms (as opposed to non-profit organizations). Recent changes in funding guidelines for federal agencies are interesting not only for these new opportunities, but also as a lesson in how the Office of Management and Budget (OMB) interprets Congress' and the President's intention in the new Federal Grant and Cooperative Agreement Act of 1977 to make government regulations less complex and more equitably applicable.

OMB's new guidelines stress the distinction between contracts, grants, and cooperative agreements. Their purpose is to make the criteria for the use of one kind of funding instrument over another a matter of the kind of *service* provided, as opposed to the kind of award recipient.

Recent changes in federal funding guidelines may make grants for unsolicited research easier to obtain for profit-making architectural firms.

What does this mean? In the past, federal agencies interpreted the old Grants Act (Public Law 85-94) to mean that grants were usually to be awarded to such nonprofit institutions as universities and state and local governments. Contracts—either the fixed price or cost-plus-fixed-fee variety—were the usual vehicle for supporting work done by profit-making firms, including small architectural firms with a research interest. The cost-plus-fixed-fee variety usually involved setting up a fee as a percentage of costs or as a predetermined amount; this fee was similar in size to the non-profit "surplus" allowed not-for-profit firms. Cooperative agreements have so far taken a back seat to the other two kinds of agreements—contracts and grants.

Grants usually have less strict performance requirements than contracts and are harder to terminate for failure to live up to their terms. In a grant, the particulars of the use of the funds are, within limits, up to the judgment of the recipient; in a contract, the particulars are spelled out explicitly. Cooperative agreements in the past have usually been reserved for large dollar-volume programs where there is both cost-sharing and results-sharing. Large national laboratories such as the atomic laboratories at Oak Ridge have operated under cooperative agreements.

In recent years, however, nonprofit institutions have also been awarded contracts when there was heavy federal interest in the products and dissemination of the research. In light of these changes, OMB has shifted to functional guidelines; the purpose of the support, as opposed to the character of the recipient, determines the kind of funding instrument to be preferred. If the "principal purpose . . . is the transfer of money, property, services or anything of value . . . in order to accomplish a public purpose of support or stimulation authorized by a federal statute . . ." and "no substantial involvement is anticipated between the executive agency" administering the funds and the recipient, then a grant is the appropriate funding vehicle. Since "public purposes" are broad goals attainable through application of the recipient's best judgment and skills, and supportable by a variety of methods, grants are the more attractive mode of support. Then, too, in cases of efforts to "stimulate" research or other work, the notion seems to be one of priming the pump rather than keeping a close watch on what comes out of it.

Contracts, on the other hand, are expected by OMB to have a distinctive procurement flavor. Here the emphasis is on acquisition of goods or services for use by the government, as opposed to work done in direct support of national policies. Contracts are to be used whenever "the principal purpose . . . is the acquisition of property or services for the direct benefit or use of the Federal Government; or . . . whenever an executive agency determines in a specific instance that the use of a type of procurement contract is appropriate"—that is, whenever the agency

wants to hold a tight leash on the recipient's product. The point is that if federal agencies follow the spirit of the guidelines we can expect more freedom in the use of grants for for-profit firms, while contracts may be a live option for the acquisition of services from untried nonprofit outfits.

The dark horse is the cooperative agreement concept, and agency and public commentary on OMB's guidelines indicates uncertainty as to the role such agreements are to play. The best guess seems to be that cooperative agreements may be reached for work involving a number of yet-to-be-determined tasks—and where the federal agency wishes to supply its own manpower in evaluating and accomplishing those tasks. Washington observers stress that the movement toward cooperative agreements may come into evidence especially in research located in universities.

What does this mean to the proposal writer? To make your research proposal stronger, look carefully at the scope of work you intend to do, at whether it benefits the broad purposes of national policy, or, by contrast, whether it fills a gap in information. Most of all take a look at the agency's funding traditions. In negotiations, a familiarity with these various modes of support can give you flexibility in determining the research approach and specific tasks to be carried out.

For example, an architectural education research proposal aimed at improving the teaching skills of architectural faculty is likely to fit the rubric of meeting the broad national policy goal of improving education, as opposed to filling an information gap. On the other hand, a look at architects' oversight of contractors in publicly-sponsored housing projects (which has recently come under Congressional scrutiny in cases where new housing had to be razed) might best be pursued under the contract formula. In this case a specific deliverable—an evaluative report—for the use of, say, the Department of Housing and Urban Development, brings the work under the category of procurement of a professional service for the benefit of a federal agency. Exploration of the more efficient use of building materials in cooperation with, say, the National Bureau of Standards Center for Building Technology, in which close interaction with NBS experts is anticipated, might best be worked out under a cooperative agreement, especially when the preliminary research results cannot be predicted.

Public and federal commentary on the new guidelines has shown observers that they are far from crystal clear. OMB has admitted as much in saying that the choice of a funding instrument depends on the context, especially with research.

Further information on the guidelines can be obtained from Thomas L. Hadd, Intergovernmental Affairs Division, OMB, New Executive Office Building, Washington, D.C. 20503 (202/395-5156). The bottom line, of course, is that your chances for funding are best when your expertise plus your proposal make an offer your client can't refuse.

—E.M.D.

Prospects

This may have been the summer of Proposition 13 on Capitol Hill. Something very much like the tax relief measure that ignited a brush fire in California this year seems to be making Congressional legislators, faced with the immediate pressures of their constituents, take a markedly more frugal approach to budget matters than their colleagues in the Senate, all of which may bode no good for architects in search of federal research grants.

The result has been confusion and some hesitancy over the fate of research programs, or at least their final budgets.

In August for example, the Senate Appropriations Committee approved a $927 million appropriation for the **National Science Foundation,** which was $33.1 million more than the $893.9 million approved by the House. Not surprisingly, the major disagreement came in the applied research budget, for which the Senate committee approved $846.4 million, while the House ordered $40 million less. By the time the budget came to the Senate floor it had received a further trim of $10 million.

One NSF source indicated that Congress, in addition to having some antipathy toward applied research, was coming down with a case of Proposition 13 fever.

The end result leaves several areas in limbo until the House and Senate can get together to work out a compromise.

All indications are that final figures are apt to be less than those recommended out of the Senate Appropriations Committee, leaving the fate and shape of several National Science Foundations still very much up in the air, including ASRA (Applied Science and Research Applications, the former RANN program), to which the Senate Committee gave $9.1 million more than in FY 1978.

This is of particular concern to architects since NSF has a major program in earthquake hazard mitigation, an incipient environmental design program, and an engineering research and science allocation.

NSF sources indicated that next year's final budget figures will probably be higher than in FY 78, but will still not cover the inflationary costs of operation.

A good example of how far apart the House and Senate can be came this summer in the budget recommendations for the **Department of Agriculture**'s Competitive Grant Program budget. The program,

which funds grants for basic agricultural research, had its budget doubled by the Senate Appropriations Committee, but the House decided to eliminate the program altogether.

"Obviously, there's a big difference between $30 million and zero," says Keith Shea, program management director (202/447-7223). "I think the Competitive Grant Program is extremely valuable. From it springs local application of research discoveries . . . but obviously the climate for research has changed. It used to be in the Sputnik era that you could just mention research and they would throw money at you. Now, and I think this is correct, there is strict accountability."

Shea indicates that a compromise between the House and Senate is in the offing.

The Senate has also recommended a $179.5 million for the **Agriculture Cooperative State Research Service.** That was $21.3 million more than requested, and also more than the $163 million recommended by the House.

Along the same lines, the Senate Committee recommended $337.7 million for federal agricultural research, $12 million more than for FY 1978, $14 million more than requested, and $3.6 million more than the House recommended.

The Department of Housing and Urban Development (HUD) awarded another round of action grants this summer amounting to $119 million for 35 cities.

The grants, made under the **Urban Development Action Grant program,** will help finance 39 joint public-private projects. The projects, backed up by an estimated $465.1 million in private funds, are expected to generate 13,000 new permanent jobs, save 11,600 others, and create 12,300 construction jobs.

The largest of the grants is $13.5 million for a neighborhood revitalization project in Denver's hispanic community. The grantees range across the country, from New York City to Waterloo, Iowa, which received a $3.318 million grant. The grants are directed at urban areas experiencing physical and economic distress.

A good example of the program is the city of Baltimore, which has received a grant of $3.3 million, backed by $6.7 million in private commitments and $.8 million from another HUD program, the Community Development Block Grant program.

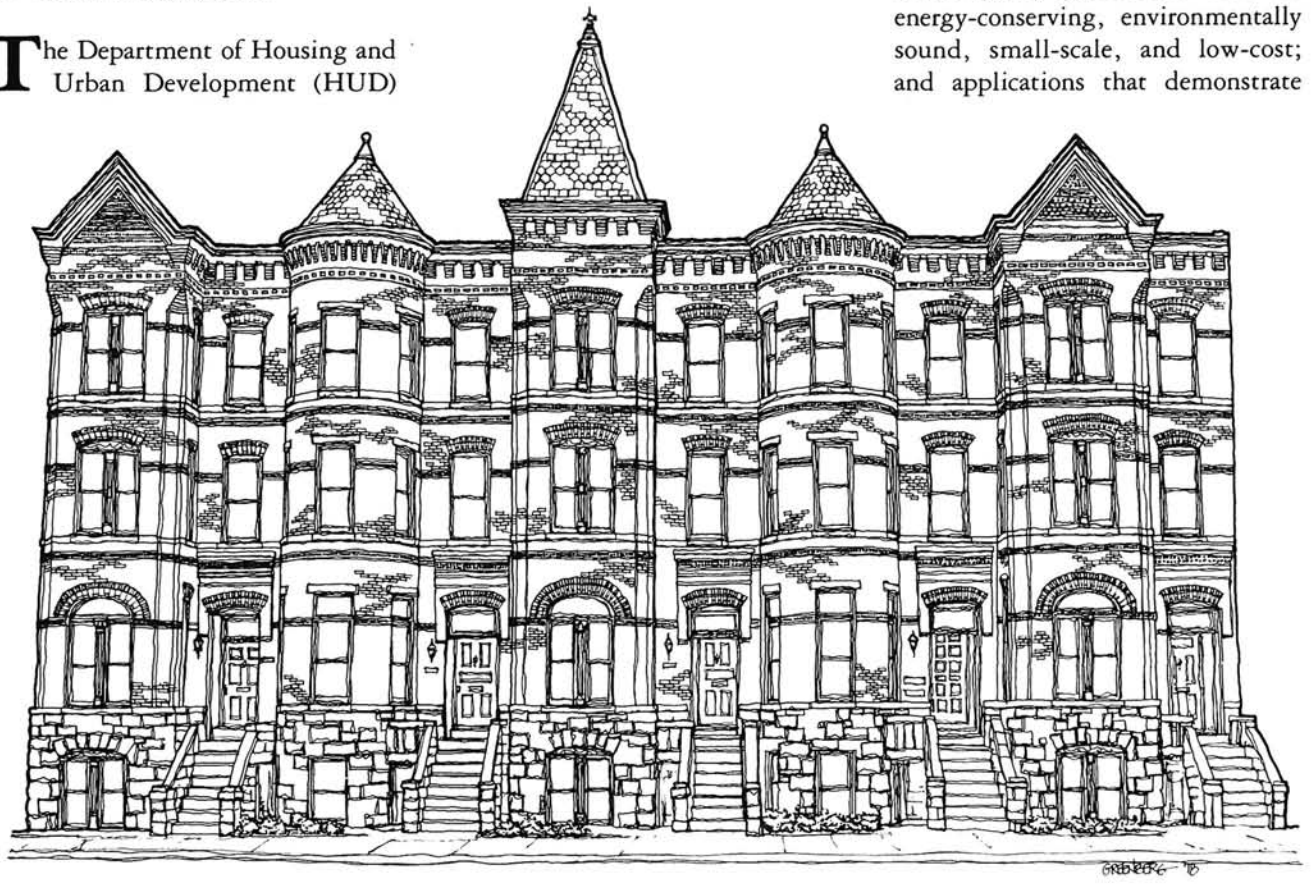
The money will be used to complete Oldtown, as part of a plan to complete neighborhood redevelopment in the heart of East Baltimore. The project is expected to mean 288 units of new and rehabilitated housing with sale prices "written down." The majority of houses will be sold at scaled-down prices ranging from $15,680 to $19,000.

The program has $400 million authorized for each of the next two years, and receives applications and makes grants on a quarterly basis. Additional information is available from HUD's Margaret Sowell (202/755-6284).

Guidelines for the Department of Energy's **Appropriate Technology Small Grants program** under the Energy Research and Development Administration appropriation authorization are now in circulation.

Proposals, however, may be submitted only in response to Program Announcements, the most recent of which was the Midwest Region announcement this summer.

The guidelines set up a program of grants, which may not exceed $50,000 each during any two-year period, for a program to encourage development and demonstration of energy and related systems appropriate to the needs of local communities, the use of renewable resources, and the use of existing technologies; applications that are energy-conserving, environmentally sound, small-scale, and low-cost; and applications that demonstrate



simplicity of installation, operation, and maintenance.

For information on the Midwest Region program contact Bill Harlow, Chicago Operations Office, 9700 South Cass Street, Ill. 60439 (202/353-5768). In Washington, contact Jerry Duane, director of Appropriate Technology at the Department of Energy, Washington, D.C. 20545 (202/376-4711).

Eighty-three more commercial buildings have been incorporated into the **Department of Energy**'s program of solar demonstration sites.

The buildings were chosen this summer in the third round of a five-year cost-sharing solar heating and cooling demonstration program for commercial buildings. They were picked from 445 proposals. Another round is expected to follow for 1979, according to DOE sources.

The proposals resulted from open solicitations. For more information call the Demonstration Program, Conservation/Solar Applications, at the Department of Energy (202/376-9623).

The last batch of 83 commercial buildings includes 21 offices, 16 schools, three museums, three stores, and three banks, as well as recreation centers, warehouses, and local government buildings. The buildings combine new construction with old sites.

This latest round puts greater emphasis on solar cooling, a concept not yet as popularly embraced as solar heating.

The DOE program operates under the Solar Heating and Cooling Demonstration Act of 1974. Thirty-two buildings were picked in April, 1976 and 80 more in May, 1977.

While it lasts, the **National Fire Safety and Research Office** (NFSRO) is a potential source of grants and contracts for architects and engineers.

The hitch is that NSFRO is part of the Commerce Department's National Fire Prevention and Control Administration, which is one of five agencies slated to be merged into an umbrella agency called the **Federal Emergency Management Agency** (FEMA). Also scheduled to be merged into FEMA are the Federal Disaster Assistance Administration (FDAA) from the Department of Housing and Urban Development, the Federal Preparedness Agency (FPA) from the General Services Administration, the Defense Civil Preparedness Agency (DCPA) from the Department of Defense, and the Federal Insurance Administration (FIA) from HUD.

It is expected that reorganization will begin sometime in January, and care is being taken not to cause any unsettling effects on existing programs. David Lucht, a deputy administrator at the National Fire and Prevention Control Administration (202/634-7654), said changeover effects should be minimal.

The research effort at NFSRO has been directed toward improved planning and technology to significantly decrease fire-related deaths, injuries, and economic losses, and to improve the cost-effectiveness of fire protection.

Grants and contracts have been awarded to architects and systems analysts for a variety of projects, including the design of a low-cost residential sprinkler system. Most awards go to nonprofit groups and state and local agencies, with universities receiving a significant share.

Other research efforts have included a study to adapt existing automatic fire suppression technology for use in residential units, development of a basic guide for fire preventional control master planning, and a program for public education planning.

Dr. Joseph E. Clark is associate administrator of NFSRO (202/634-7722), and the director of Technology Development is Harry Shaw (202/634-7195). NFSRO's mailing address is P.O. Box 19518, Washington, D.C. 20036.

Got an idea for a better mouse trap? Or, for that matter, for a better architectural programming system?

Better check with the people at the National Science Foundation before you run off and try to sell your idea or newly wrought invention to some idea broker with lots of promises. Otherwise, you may lose your shirt *and* your mousetrap.

Back in 1973 NSF perceived that inventors, who seemed to be a dying breed in a nation that once nurtured them, needed some help. The kind of inventor NSF had in mind was the solo tinkerer, that American original who often went broke selling his idea. In 1973 the total number of patents issued had risen sharply but, oddly enough, the number of individual inventors had dropped. Part of the reason was the presence of idea brokers, who charge exorbitant fees for promising to market an inventor's ideas. The promises and the fees are often high, but the results of the idea brokers' work are often negligible. Inventors seldom know how to sell their inventions or ideas on their own.

With these facts in mind, NSF began the **Innovation Centers** experiment with a budget a little less than $4 million and units at the Massachusetts Institute of Technology, Carnegie-Mellon University, and the University of Oregon.

The first two centers concern themselves with special teaching programs, but the University of Oregon decided to come up with a comprehensive evaluation program for judging an inventor's invention. The Oregon center's goal is to evaluate the practicality of the invention and, if it proves valuable, help the inventor market it.

The system uses a 33-point computer program that looks at what makes or breaks an invention, including such issues as: Is the idea safe for and beneficial to society? Is the idea likely to make profits? What is the need for the idea? Will people want it?

The Oregon center helps an inventor develop and market an idea for a percentage of royalties or a negotiated fee, not an up-front charge like many idea brokers. The center deals mostly with transferable inventions or marketable ideas, and sometimes it counsels *not* patenting a new idea.

For more information about the Unversity of Oregon center contact Dr. Gerald G. Udell, Innovation Center, College of Business Administration, 131 Gilbert Hall, University of Oregon, Eugene, Ore. 97403, or call Udell at 505/686-3326.

—E.M.D.

COMMENTARY

***Bechtel** (continued from inside front cover)*
assumption is that he knows what is best for humanity.

It should be obvious why post-occupancy evaluation will contradict these two kinds of creativity—they are not humanistic enough. The data from a POE evaluates whether a design suits human needs. This is an essential form of humanism, and it is a sure way of guaranteeing humanistic design. Basically, the POE supports a different kind of creativity. Let us call this *caring* creativity, a creativity that shows by its expression that the architect *cares* for the client or clients.

For some this will be an entirely unheard of proposition. For others who already practice it, the reaction will be annoyance at mentioning the obvious. I do not mean to imply that all architects, or even most, are egotistical and paternalistic. The point is that there is much more to the creative process than most people recognize—it can easily absorb all the "sterile" figures that social scientists can throw at it and survive if it is humanistic in purpose.

The numbers that the social scientist comes up with in a POE are only sterile to those who do not understand them. The scientific process is a truly democratic maneuver. The numbers represent the behavior, feelings, needs, and attitudes of people. They are numbers because they represent *numbers of people.* Many practitioners cannot (or do not want to) make that kind of jump in their thinking. They can deal with one person's needs, or maybe a committee's, but not the concept that their buildings must satisfy the needs of untold thousands of people for forty or more years. POE brings all of us closer to meeting such a goal.

So the use of post-occupancy evaluation opposes the egotistical and the paternalistic views of the creative process. Its numbers and esoteric concepts bring a harsh proletarian dimension to the process that can be understood only by a designer seeking a link between his creativity and the people he serves. I suggest that for all those who practice it, this kind of creativity is infinitely more satisfying than all the other kinds. I've had the very great pleasure of being a social scientist who has worked with many architects and done many POEs. We have always learned from each other. It has been fun to combine social science and design. It has opened up new fields of creativity for both architect and social scientist and it adds the extremely satisfying dimension of expressing care and concern for the numberless thousands who will occupy a building during its lifetime.

***Blasdel** (continued from inside front cover)*
how the results are relevant to new designs. The breadth of relevance demonstrated in the research can suggest application of results where the elements and configuration of a design go beyond the particular designs on which the research was based. Designers should also be able to examine tested cases for insight beyond what can be reported as research results. If the results are sufficiently clear and specific, designers will be able to take well-founded and articulate exception to some of them by providing alternate cases with significant new implications, thus helping to refine the state of the art.

The comments made in the July *R&D* lead one to an alternate approach to POE research; one involving more collective foresight, evaluation of significant designs, and which places research validation after design intuition. In this model, professional design opinion would be critical to relevant research. Designers would evaluate existing designs for a building type as if the designs were not yet constructed, selecting the most significant and indicating what they believe to be the behavioral and perceptual implications of each design. This approach models the pre-construction design evaluation process, and could be related to a jury system. To the extent that design professionals begin to agree to these implications and their relevance, hypotheses would be developed worthy of the major investment POE research requires.

To extract useful research results, several tens of buildings would be needed of a particular type, and to fund the research it would be necessary to select building types with the prospect of further major construction or renovation investment. The reward would be the codification of knowledge about those building types.

There is no need to evaluate only new buildings; we already have an ample base from which to learn. Good designers learn from this base all the time; POE research could help designers to share that knowledge and to identify designs which extend the bounds of what is generally known in the profession. Research will always lag behind innovative design, but by following design innovation closely, research will become more relevant and informative. With the combined advance of technology and bureaucracy there is no time, and all too little respect, for historic perspective; hence the need for new learning methods and new ways of supporting professional judgment.

Clients are becoming increasingly sophisticated in their expectations, and the time may be approaching when the profession, in collaboration with its clients, can responsibly undertake several intensive building type evaluations. Social science expertise is developing in the schools of architecture which could economically support such extensive on-site design and behavioral studies, and this involvement would also give emerging practitioners the benefit of evaluating senior design insight. Academies are planned within AIA with the expectation that each will help to focus the body of knowledge in its particular area. And there is a growing respect between the research and design communities which could make such national projects feasible.

There is clearly a market for improved architectural services; the profession needs to take the lead in aggregating that market to support research. With the increasing pace of technology and an ever tightening web of design constraints, the profession needs to accelerate the pace of learning—about the impact of design, about ways to evaluate and control that impact, and about ways to support its insights with research data. With progress these days, the need for a humane and sensitive architecture only increases.

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