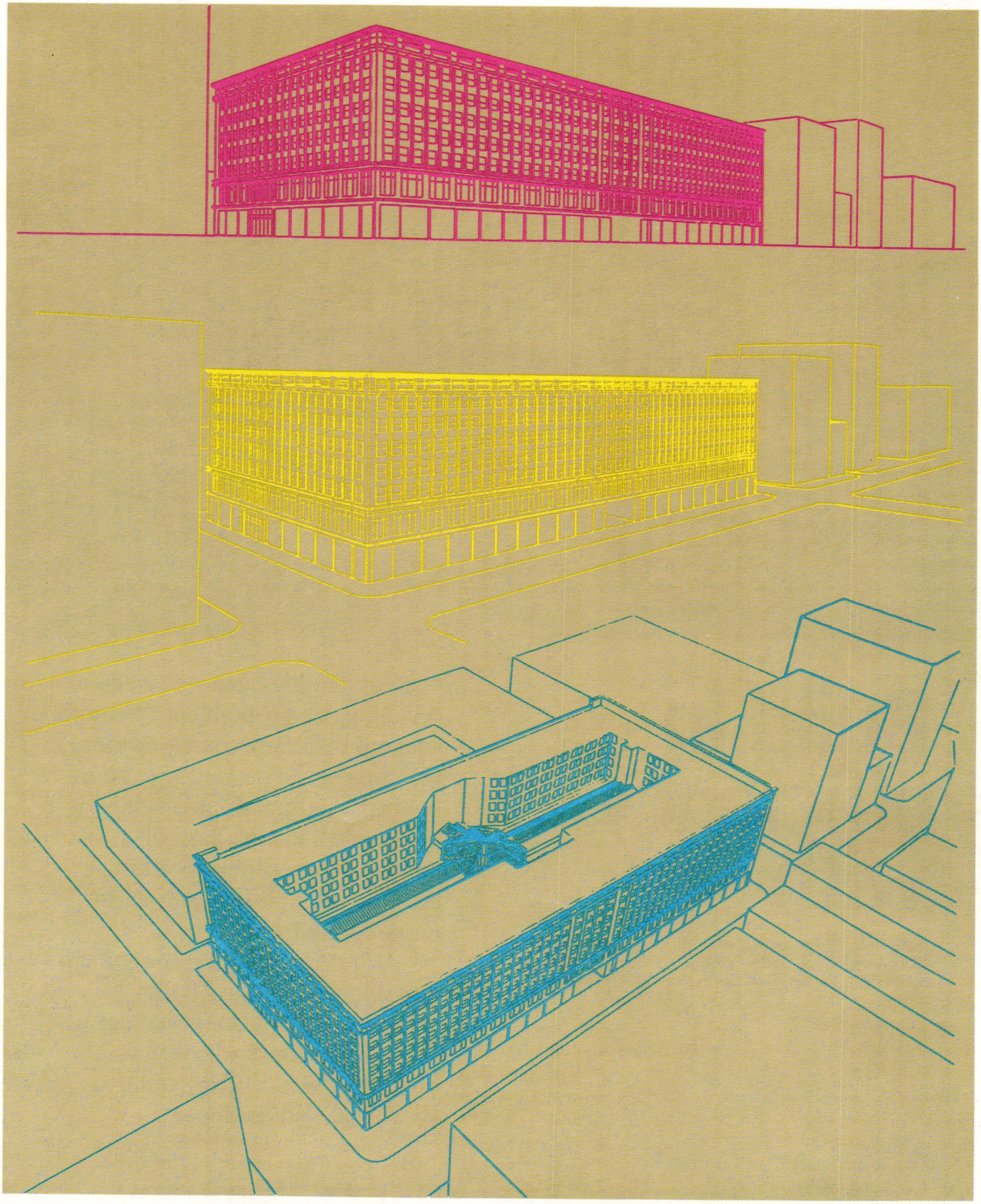
Wisconsin Architect



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August 1983

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COVER CREDIT -
A computer generated composite of three views of the Plankington Building, part of Milwaukee's "The Grand Avenue". The computer graphic model was built by Pete S. Bochek as part of his thesis which analyzed and compared two of Milwaukee's atrium designs. These graphics were used in analyzing iradiation and shading on the canopy of the arcade style atrium. The computer program was written by Associate Professor Anthony Schnarsky.

Introduction

By David Evan Glasser, Chairman
Department of Architecture
School of Architecture &
Urban Planning, UWM

This is the second successive year in which our Department has been asked to take the initiative in preparing the annual summer issue of Wisconsin Architect devoted to energy related architectural design issues. In considering a theme for the issue, my colleagues and I were struck by the growing maturity in the use of passive design strategies in projects throughout Wisconsin. Thus the focus of this year's issue is the coming of age of energy in design in Wisconsin architectural practice.

The principal article in this year's issue describes seven projects built throughout the State by architectural firms of varying size. All projects have in common the high priority accorded thermal performance by both clients and architects. Projects were purposely selected from seven distinct regions of Wisconsin in order to convey what I believe to be the actual state of affairs in our profession, which is to say that energy concerns are playing an increasingly dominant role in design practice in all parts of Wisconsin.

The projects range from major commercial buildings with multi-million dollar budgets to extremely modest structures. While all the published designs are successful in terms of meeting their intended thermal performance criteria, some are perhaps more architecturally successful than others. In order to probe this tender relationship between new energy considerations and traditional architectural design concerns I have included comments and observations following the presentation of each project. It should be pointed out that each firm was queried as to whether they would agree to having an objective critique included in this statewide survey. I am deeply appreciative of the universal agreement I received to append commentary that I might think appropriate.

In this regard, comments made about each scheme are intended to be constructive and thought provoking in all cases. Our faculty and students continually struggle over the appropriate role of energy concerns in building design. Some feel that it represents one of the principal, if not the most important, form determinant available to the architect. Others feel that it is one of many competing factors to be considered and should be subordinated to other traditional concerns. As might be imagined there exists as well the full spectrum of opinion between what I might choose to call the "energy-conscious mannerist" design approach and one relying on modest and anonymous solutions.

It is comforting to note that Wisconsin practitioners are dealing with the same kinds of issues and embody the same broad range of attitudes towards energy in architecture. It must be said that, as a group, the architects represented have made a serious commitment to incorporation of energy conservation measures as an intrinsic part of their professional practice. The universality of this commitment offers the objective architectural critic the opportunity of comparing the relative merits of design strategies which assign energy concerns differing priorities within the design process. Thoughtful practitioners will want to ponder to what extent, if any, traditional design objectives can or should be subordinated to thermal performance and energy conservation factors.

In concluding I wish again to express thanks for the gracious consent of the represented architectural firms to have their work illustrated and analyzed. Their cooperation has permitted us to assemble what I think readers will find a remarkably useful and informative survey of current mature architectural practice in Wisconsin.

E-CADD!

By Anthony Schnarsky,
Associate Professor UWM

CADD means Computer-Aided Drafting and Design. This exciting and fast developing technology will positively transform the ways architects render their services. If you have been observing this trend as a cautious and interested bystander, you have lots of company. However, professional employment of CADD can no longer be deferred or avoided. Looking to the future it is certain that within the time it takes to formally educate an architect more than half of the Wisconsin architectural community will be using some form of CADD with enthusiasm and success. For those readers who do not believe this, you can stop reading right here because this article is not for you.

This article will introduce you to fundamental CADD concepts. The focus of this paper will show how a typical vendor supplied CADD system can be used to explore architectural design with an emphasis on energy issues. "E-CADD!" describes new energy design procedures made possible with computer assistance. It is important to clarify that E-CADD type energy design applications are advanced, high level capabilities that should increase your reasons for acquiring this tool. However, the primary reasons for acquiring and using CADD are to help lower the cost and time of producing 2-dimensional construction documents and to supplement technical design.

The exciting quality of the E-CADD applications is their 3-dimensional nature. See figure 1. In addition, E-CADD can take place during schematic and preliminary design phases. While the E-CADD graphics appear simplistic, experience has shown that this kind of user application occurs only after a great deal of time has passed using the system, and after the designer has become comfortable with the tool. Realistically it requires more than one year with the tool in your office before 2-dimensional production documents are comfortably and efficiently produced. The special

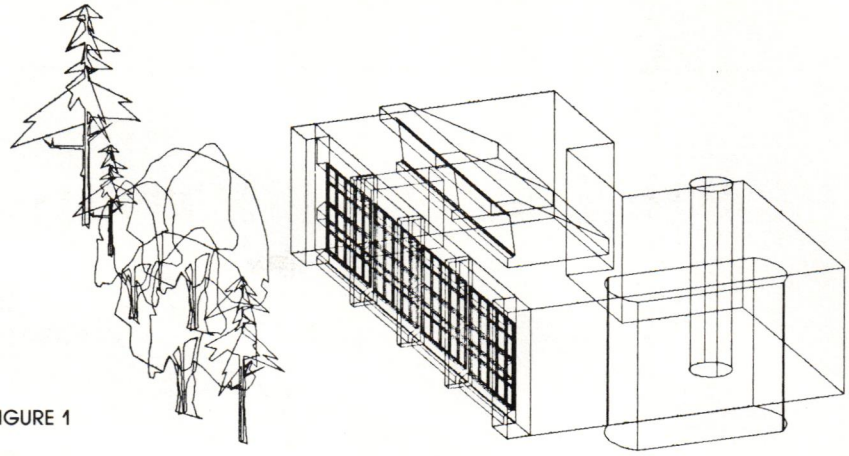


FIGURE 1

Figure one: This is a 3-dimensional graphic model produced by a CADD system. The view is an axonometric view of a passive solar office building with some vegetation in the context.

applications of energy design on CADD using 3-dimensional techniques may take several years before user confidence is established. These E-CADD graphics are well worth the effort because they can be visually assessed as well as quantitativity measured. This article was written to demonstrate that not only production economy is promised with these new tools, but after that awaits the exciting potential of design exploration. E-CADD illustrates the marriage of quantitative and qualitative design methods possible only on these new tools.

All of the graphic work shown was done on a CADD system in Wisconsin by designers with established experience in energy design. In addition, these designers have had more than three years of 2-dimensional CADD contract document production experience. The progression into three-dimensional modelling, energy design and solar graphics, all integrated within a single CADD system, constituted an advanced step for these designers. The graphic illustrations shown are un-retouched CADD plots produced by a vendor-supplied CADD system. The system was so well designed that these unique studies of a building were possible even though the manufacturer could not forsee the possibility of using the tool for energy design and solar simulation.

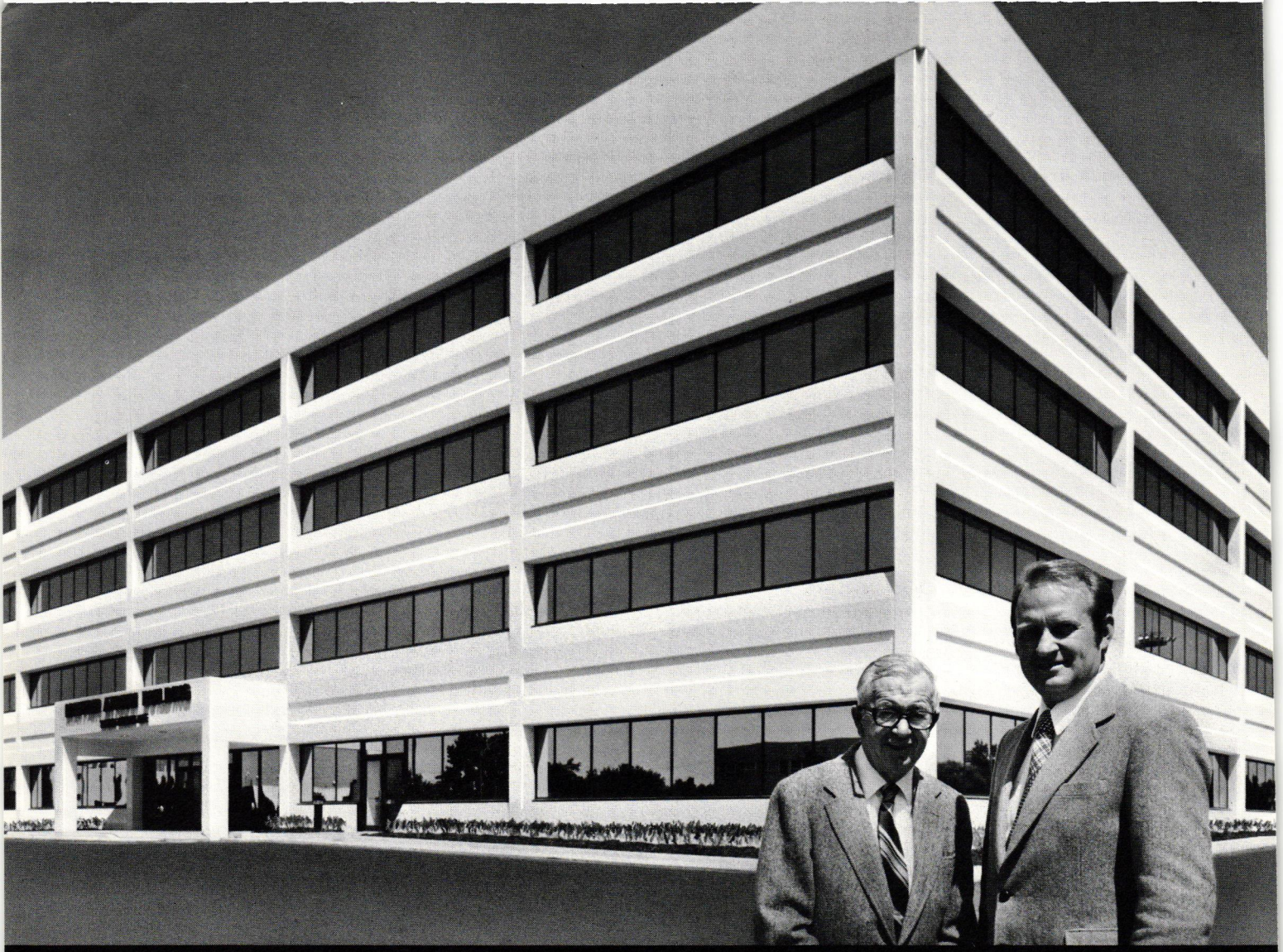
To better understand system potentialities, presented below are several concepts intrinsic to any CADD system. The features supplied by various computer companies have different concept names and degrees of capability, but most systems can perform the functions described.

All interaction with, or use of, a computing system fundamentally consists of pushing the correct sequence of buttons and observing machine output. It is this simplicity of function which makes computers such powerful tools. After several years with computers, new words and revised meanings of old ones become part of one's language. The following words are "commands" which are requested by pushing buttons on a CADD system. These are concepts describing machine functions which illustrate how producing contract documents will change when employing CADD. It is not to be expected that these words and concepts will be completely clear on first reading. These concepts are explained later in the article. Remember that the primary goal of a CADD system is to build a graphic representation or picture consisting of lines, symbols, shapes, dimensions and text by just pushing buttons. Here are the main ideas:

BUILD: Place graphic elements using geometric commands.

PROCESS: Manipulate already created graphic representation so as to store, retrieve, copy, transform, merge or modify any part.

VIEW: Provide complete control to view or print any size, scale, part or



Profit Improvement...Three Ways

All alternative methods of construction were considered by developers of the luxurious, 80,000 sq. ft. Mayfair Atrium Building. One offered favorable initial cost, significant savings in construction time, and the assurance of reduced operating expenses.

WILLIAM BURNS, VICE PRESIDENT & GENERAL MANAGER, FROEDTERT MAYFAIR, INC., THE MAYFAIR ATRIUM BUILDING, MILWAUKEE:

"J. W. Peters, with our architects and engineers, provided a totally prestressed concrete building—including structural frame—without compromise of quality or appearance. We will benefit from reduced maintenance costs for years to come. We have already appreciably benefited from the speed with which the Mayfair Atrium Building was completed. J. W. Peters met all our objectives."

(Mr. Burns, left, with Bob Hassey of J. W. Peters)
Architect: The Zimmerman Design Group
Engineer: Brust Engineering Inc.

JW PETERS
AND SONS West Market St., Burlington, WI 53105
414/763-2401 (Burlington)...414/272-7222 (Milwaukee)...312/782-4691 (Chicago)

combination of graphic representations.

GRID: Provide variable dimensional ordering system.

MEASURE: Quantification can occur on any graphic element so as to measure length, perimeter, area as well as data base associated attributes.

CELL: Library files save cells enabling retrieval of standards or repetetive graphic elements.

PROGRAMMABLE: CADD systems allow users to program special commands specific to that office's particular design process.

BUILD AND VIEW

Building a CADD graphic involves the use of digitizers, menus, and graphic screens. Most of the build-up involves the user watching a high resolution, TV-like graphics screen. The digitizer allows entering of previously drawn or surveyed information by tracing with an electronic pen. The menu provides choices of all possible geometric commands and of view control. For example, any platonic solid may be selected and easily placed in the CADD graphic. The designer usually selects a command and then refers to the screen for the position of this latest addition or modification. An example would be to "PLACE CIRCLE". After picking the command from the menu, the designer would then place points on the screen and the circle would appear. If required, the circle could be moved or resized. When the work is at a stage for reviewing, a plot can be made for others to refer to and mark-up. Figure two, is a section through a passive solar designed building. It is a CADD generated, 2-dimensional construction document. Notice the rich variety of graphic elements, text, fonts, line weights and line types. To facilitate the build-up of a design, some CADD systems provide multiple screens and several views on a single screen. This means, for example, one can look at a plan or part of a plan at one scale, and a "zoomed in" view of a detail at another scale. View control also allows within each view a variety of types or "levels" of information to be displayed in relation to the established dimensional grid.

PROCESS

First and foremost, CADD functions very much like a word processor. If purchase of a word processor is being considered, it may be worth examining the primary reasons for obtaining one. A word processor's most important feature is its ability to facilitate changes. It is both a humane and responsive tool. A CADD system fundamentally has the same capability as does the word processor to CREATE, STORE, RECALL, REFER, INSERT, DELETE, MOVE, MERGE, and PRINT. Instead of words, the CADD system manages lines, symbols, text, dimensions and data base. An integrated system suggests the possibility of building up a design from early sketches by additions and overlays in successive cycles. Each cycle permits reference to, or merging with previous parts of other designs right up to final printing before bidding. Within each cycle current documents may be printed for communication with other designers, consultants and the client. The speed and ease of producing interim design sketches are substantial advantages as may be imagined. Much as a word processor facilitates a writer's process of polishing and refining a written document by drafts, so does the CADD system encourage refinement of graphic documents and the design itself.

MEASURE AND GRID

If part of typical design development activity can be conceived as choreographing of dissimilar components and building products, then CADD offers real assistance. Essentially, a grid of any size can be specified in relation to other superimposed grids. This relationship can interactively change at any time in the process. The designer has the following options with the system: the grid can be shown or not; Elements can match the grid or otherwise; Elements can connect with other elements or remain separate. Finally, a CADD system has measurement and quantity take-off commands that can match any building design or technical tolerance. Some CADD systems actually lay down a pixel of light for each grain of material in the building at full scale. Grid capability provides the means of helping designers refer to a measurement system. Another important CADD feature is called "referencing" which permits several other CADD graphics to be viewed simultaneously. A common example is to have an already drawn plan showing on the screen as a light grey reference image while the user is designing in section or elevation. This is just like laying a transparent drafting film over the plan only it is done electronically. For technical coordination, a consulting engineer could "refer" to architectural drawings while developing a particular system. An energy-related example of this type of coordination and quantification is illustrated in heat gain and loss calculations. An engineer could, by using the same drawings as those prepared by an architectural designer, derive gross and net areas for heat gain and loss analysis. The CADD system is very precise and particular in its measuring capabilities. The engineer would simply trace, with data points, the various surfaces. Subtle corrections for frame sizes and wall ends and floor edges can be accounted for with such an accurate tool.

CELLS

The last fundamental concept for CADD in this report is termed the library "cell". This technique embodies the ability to store and retrieve graphic elements which are standardized or are generic and continually improving. Preparation of cells require considerable time investment. They must be derived such as to fit into many differing design contexts. There are two types: those for a fixed product with a set of fixed sizes and those built at a unit size. When the cell is "placed", its final size in any direction and its orientation is defined by user-specified parameters. Cells can be placed on any graphic level and can have variable line weight and line symbology. The tree "cells" in figures in this article

took about 20 minutes to create and catalog. To plant a group of 30 trees on a sloping site, where each tree is a different size, orientation and even proportion took no longer than 20 minutes. The trees illustrated may appear stiff and unreal, but it must be realized that they are quantitatively accurate for approximating the shading effects. For energy design this provides precise information about the effects of context on solar access. The reader may be surprised to learn all of the trees in these graphic displays came from only two unit cells. Figure two has four graphic elements in it created from fixed cells.

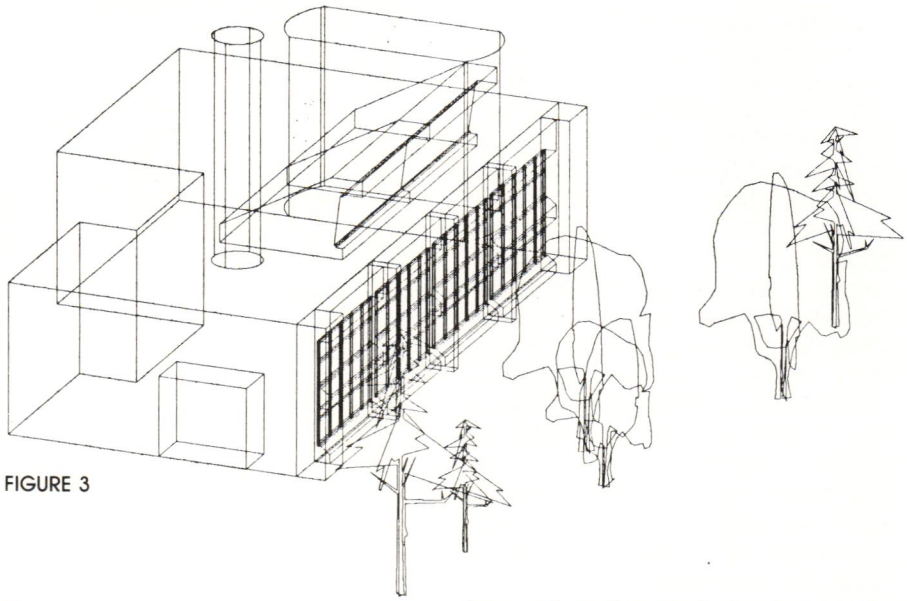


FIGURE 3

Figure three: This is a "sun's view" of the design at exactly 4:00 p.m. on a day of Equinox (March or September 23).

ENERGY APPLICATION

Most of the production benefits of CADD occur in the 2-dimensional mode. As discussed, some energy related quantification and technical integration occurs in that mode. The most productive and rewarding energy design takes place, however, in 3-dimensional modelling. Working in 3-dimensional graphics file is very challenging and stimulating for architectural designers. This ability can be achieved in a period that normally takes six to twelve months. In a CADD 3-D graphic display, data must be entered using multiple strobes of data points in different orthogonal views. That means, for example, that X, Y information is entered in plan view and Z information is entered in an elevation view. Given experience, designers ought to be able to generate models similar to the ones illustrated in less than 2 hours.

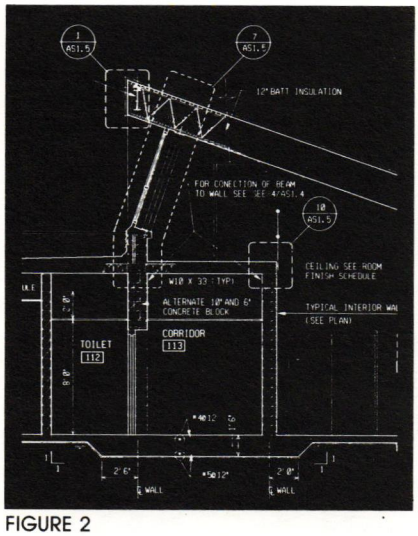


FIGURE 2

Figure two: This is a 2-dimensional graphic of a construction document. It is a large scale section through a passive solar building.

The capacity of a CADD terminal to rotate a view about three perpendicular axes in space and to center and focus on any part of the design provides users with the capability to visually assess the design from any vantage point. This suggests that the development of virtually any axonometric or perspective view is obtainable. For energy considerations the ability to "see" the design from the position of the sun is an important factor. Any CADD with 3-D capacity is able to generate a rotated view to match the azimuth and altitude of the sun at any time during the year for any location and orientation. All of the "sun shots" shown were initiated as plans that were first rotated so that vertical edge shadows were cast upward. In the next step these "azimuth rotated" plans were tipped to match the altitude of the sun at that instant. Once this is accomplished designers could exactly compute any receiver surface area with respect to irradiation. In the same way designers could closely analyze a window with deep frame and shading devices and accurately determine how much sun would enter the window area.

In conclusion, I should like to close with repeating the claim so that you will consider CADD as part of modern professional practice. The E-CADD illustrations embody the special art of visually and quantitatively developing a building design within conditions of contextual and technical issues. Energy application

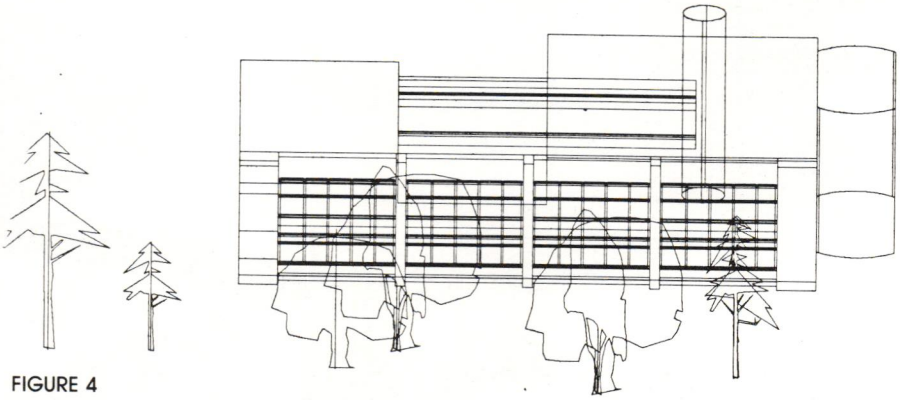


FIGURE 4

Figure four: This is a "sun's view" of the design at Noon on Winter Solstice (Dec 21). Note that if the trees had foilage several window panels would be shaded.

tions are not the only technical issues possible, but they are of an exemplary kind. CADD systems do assist in this integrative design process. In addition to the increased speed and productivity associated with word processors it will be seen that a well selected system with good geometric and 3-dimensional capability will permit exploration of proposals from inception through definitive design, permitting refinements and improvements not normally possible given usual time and fiscal constraints. Furthermore, energy conscious designers will find that CADD permits building design to proceed simultaneously using visual and thermal performance criteria. In the future CADD systems will be available with menu commands, such as "sun view" or "compute annual energy". Using these systems designers will be able to make concurrent decisions based upon visual evaluation, intuition, context and technical performance. It is worth restating that all of the figures and observations made were generated locally. Architects within our region are to be congratulated for their serious attempt to combine energy considerations with traditional architectural concerns.

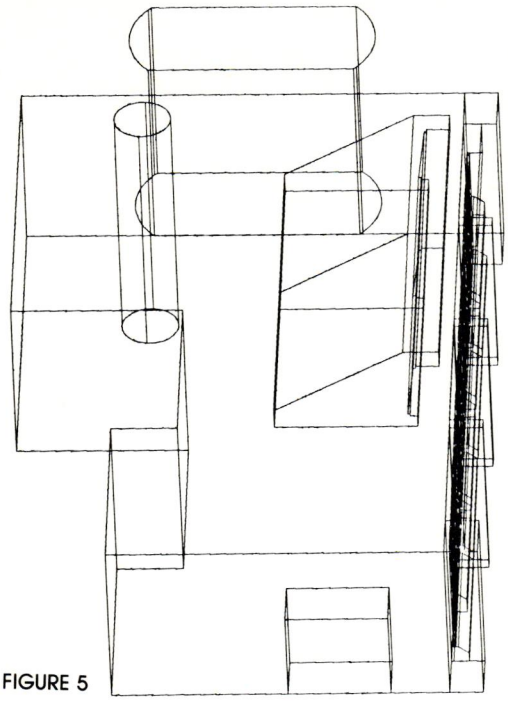
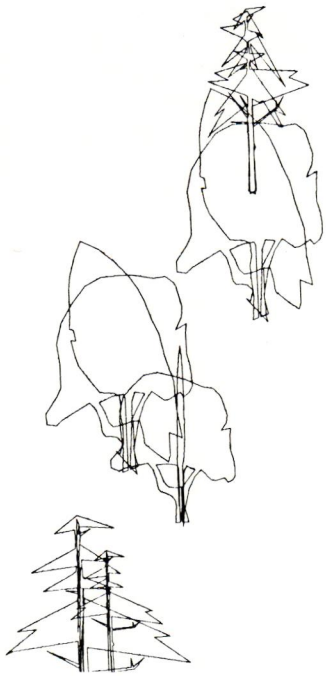


FIGURE 5

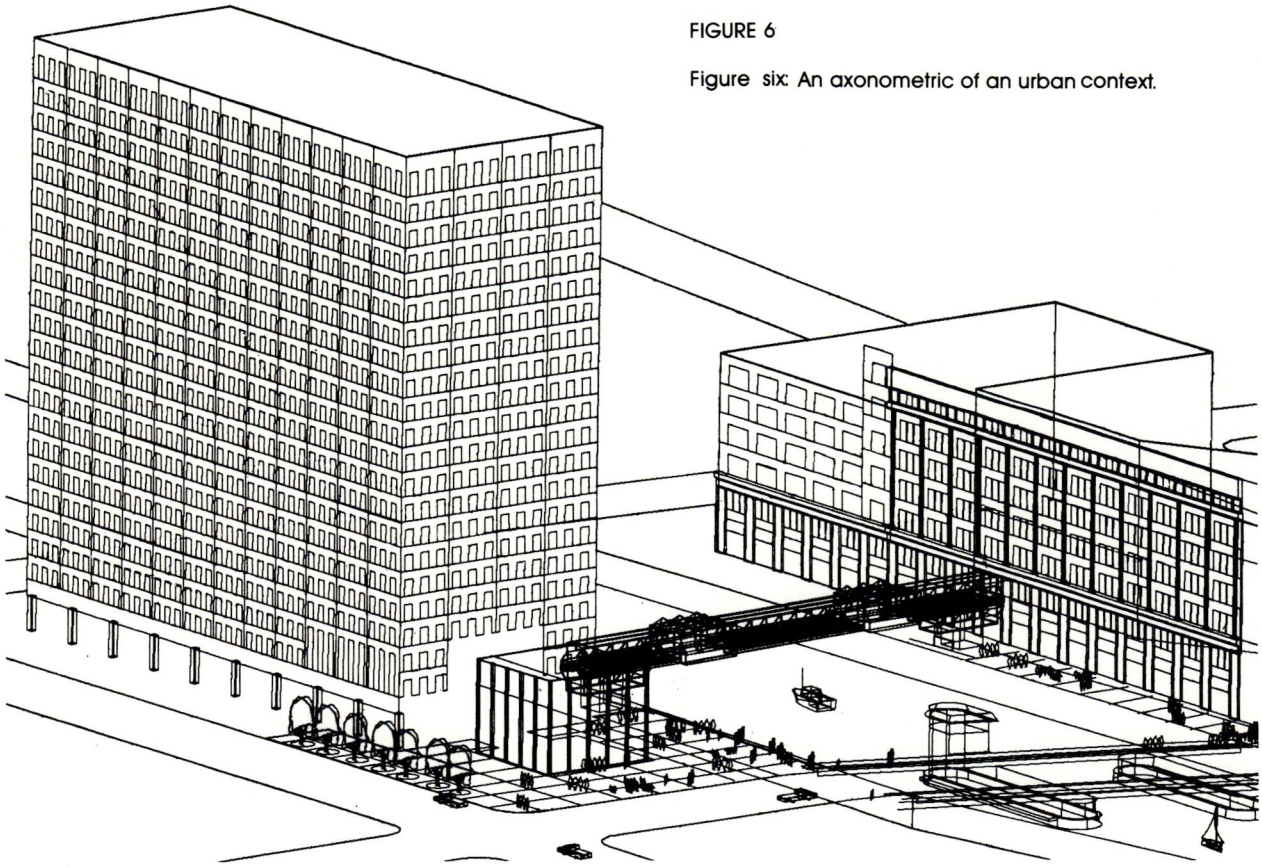
Figure five. A "sun's view at 4:00 p.m. on summer solstice. Notice that sun is completely off the collectors.

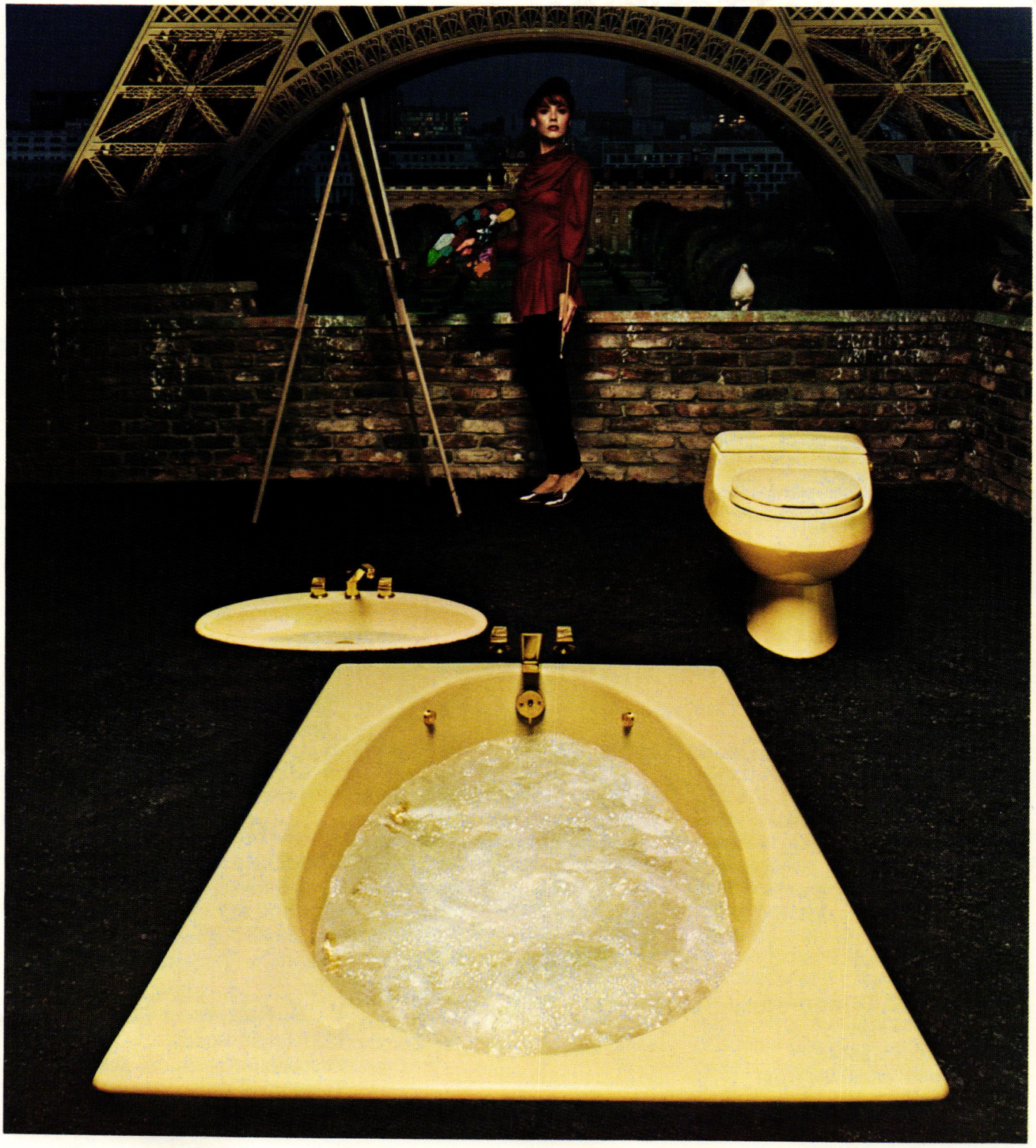


Appreciation is accorded the firm of Donohue and Associates for its openness to exploring the design potential of this new tool. The illustrated 3-dimensional models of a passive solar design were by Gary Garrigan. Special thanks is given in particular to Brad Eckrose and Bruce LeRoy, both of Donohue, for their patience and sharing expertise.

FIGURE 6

Figure six: An axonometric of an urban context.





FRENCH VANILLA..."MAGNIFIQUE."

Leave it to the French to take something as simple as vanilla and give it spice. Make it richer, creamier and tastier than it's been before.

Leave it to Kohler to bring it to the bath.

French Vanilla. Kohler's newest color leaves your decorating palette wide open because it blends so beautifully with any shade; yet stands by itself with a flavor uniquely its own. Exhibited here on the new Pristine™ Bath/Whirlpool, Ellipse™ lavatory and Rialto Water-Guard® toilet. Just a small part of the gallery of bath and powder room fixtures Kohler has created in French Vanilla.

This is a color that must be seen firsthand to be experienced. To view French Vanilla, as well as the full spectrum of bold Kohler colors and exciting Kohler products for the kitchen, bath, and powder room, check the Yellow Pages for the Kohler showroom near you.

THE BOLD LOOK OF **KOHLER**

Fig. 2
Reflecting mirrors at base of bell tower help reduce requirements for artificial lighting in the interior. Note the glazed acoustic reflecting element over the pulpit.

Fig. 3
Principal view of Central United Methodist from Wisconsin Avenue. Note use of bermed earth along front and side elevations.

Donohue Headquarters, Sheboygan, Wisconsin

By Donohue, Engineers & Architects with Syska and Hennessy, Energy Consultants of New York City

Donohue, an engineering and architectural firm, completed the 25,000 square-foot addition to its Sheboygan, Wisconsin, headquarters in June 1981 at a cost of $1.5 million. The design was a combined effort of Donohue staff professionals and selected staff of Syska & Hennessy, an energy consultant located in New York City. A design/build approach was carried out by the general contractor, Charles D. Smith and Son of Fond du lac, Wis.

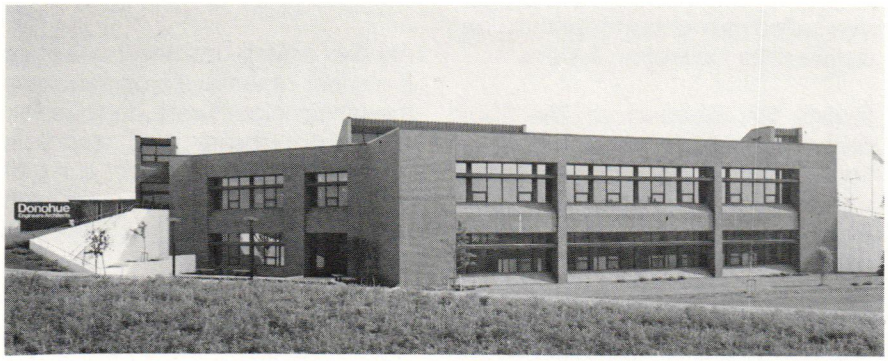


Fig. 1
New office addition facing south. Note skylights, deep set fenestration and continuous light shelves on each floor level.

The two-story building is oriented with its long axis in an east-west direction, providing maximum southern exposure for daylighting and passive solar heating, and northern exposure for additional daylighting performance and quality. The site is 650 feet above sea level, at a latitude of 43 degrees north, with a winter design temperature of -15 degrees Fahrenheit, 8,000 degree days, and an 87 degree Fahrenheit summer design temperature. The locale has 44 to 48 percent yearly sunshine.

DAYLIGHTING TECHNIQUES

The building's daylighting techniques, supplemented with automatically adjusting flourescent fixtures, are geared for both cost effectiveness and quality of light.

Long banks of windows extend across the southern, southwestern, and eastern exposures on both levels. On the north, windows are included on the upper level only. Large amounts of window area allow sunlight to serve as the office's primary light source, providing approximately 60 percent of the total energy needed for lighting.

South and southwest-facing windows are divided vertically: the lower portion, reaching a height of 7'4" above the floor, is made of double-glazed, glass with glare-control qualities; the upper portion is triple-glazed clear glass that extends to the ceiling, a height of 10'4" above the floor. Light shelves, set between the two sections, reflect daylight onto the ceiling, providing diffused light to interior portions of the building. This system includes a prefinished metal exterior light shelf and an interior light self with an aluminum specular reflector. North-windows, however, use light shelves only on the interior rather than containing a reflector, and have an upper surface of white-painted gypsum board to help diffuse light. (see wall section)

A clerestory and two-story atrium provide additional light to interior areas. The sloped clerestory glass is protected by an overhang de-

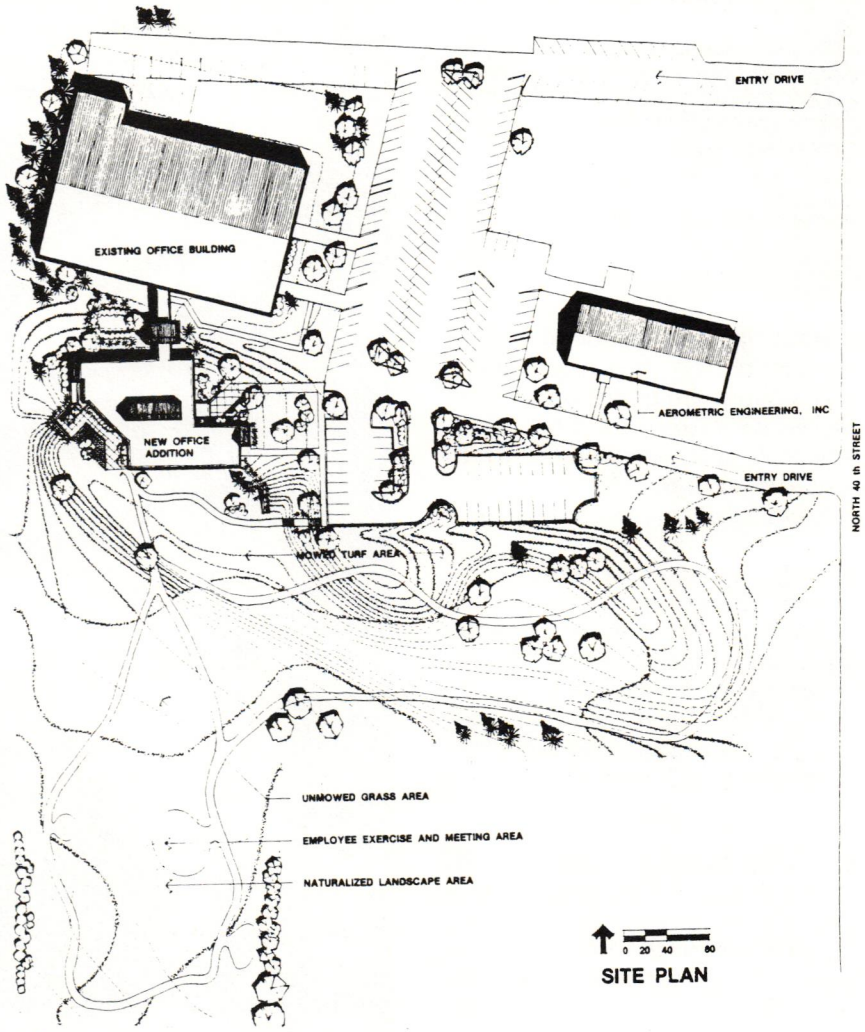


Fig. 2
Site plan shows how addition uses earth berming on north, east and west sides for improved insulation. Addition is positioned to optimize passive solar collection.

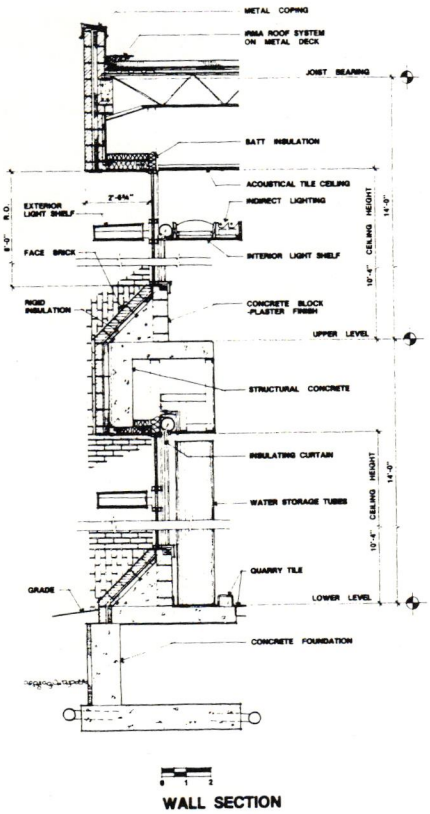


Fig. 3
South wall section explains several key energy related design features. Interior and exterior light shelves, massive masonry construction for nighttime re-radiation and water storage tubes.

signed to exclude most of the direct sunlight during summer, minimizing summer cooling loads.

Indirect lighting is incorporated throughout the building. Interior work stations are designed with low partitions to allow maximum light reflection to the interior. The partitions are constructed of acoustic material to minimize noise levels.

Serving as supplemental light sources, fluorescent fixtures are suspended at 7'4" above the floor. Attached sensors automatically adjust light levels as daylight intensities change. This sytem prevents excessive use of energy while providing a constant light level at the work surface.

The office is designed for 2.5 watts per square foot, compared with 5 watts per square foot in most commercial buildings. However, this lower wattage, which means lower electricity bills, produces an average of 70 ESI foot candles, compared with the average building's 20 ESI foot candles.

PASSIVE SOLAR HEATING

The large banks of windows facing south and southwest also provide passive solar heating. According to the engineering consultants, vertical south glass collects more heat than a solar collector. Passive solar features, combined with heat from lights and people, are expected to provide nearly 35 percent of the energy needed for heat. Cost effectiveness was a goal here, too, as the payback period on the passive system is much shorter than an active solar collection system.

Quarry tile, installed on the floor area adjacent to windows, functions as a thermal mass, releasing stored-up heat at night. On winter evenings, insulating curtains operated by timers cover the lower portion of the windows to retain building heat gained during the day. In the morning, the curtains rise to allow the sun's warmth to enter the office. Each curtain can also be operated, manually, thereby accommodating individual employee comfort.

Thermal mass walls ensure the effectiveness of these passive solar features. The building has an envelope U-value of .09 with a winter performance design of 7.5 BTUH per square foot. Foundation and wall structure is a combination of poured concrete and concrete block backup, with rigid insulation in the cavity and a brick exterior. Floors are quarry tile or carpet over poured concrete. The roof system consists of steel joists, metal deck, rigid insulation, and single-membrane roofing with ballast.

Another energy-conserving feature is a series of water storage tubes in the atrium's southwest windows. Designed to absorb and reradiate heat produced by direct sunlight, they are made of plastic reinforced fiber glass and each filled with 132 gallons of water.

COOLING AND HEATING SYSTEM

The heating system consists of a hot water boiler and perimeter radiation. There are two solar-compensated zones of radiation, and the perimeter radiation, together with

Fig. 4
Water storage tubes in two story reception lobby area provide nighttime heating during winter.

unit heaters at entries and in the upper-level ceiling, provides auxiliary heating requirements.

The ventilating and air conditioning system is a variable air volume system with a single central air handling unit, medium pressure, 21,000 cubic feet per minute. Inlet vanes are used on the supply with return/exhaust blowers. Room and area air terminals have integrated thermostats.

Cooling loads are reduced in several ways: each sheltering is provided around the lower level on northern exposures; the south facade is recessed and protected from direct sunlight between the end of April through early September by the building overhang and the intermediate light shelves; reduced fluorescent lighting usage results in less heat so air conditioning loads are lower; finally, windows are fitted with operable sections that are used in the summer to let in cool night air, which is then so tred in the building's thermal mass walls and floors in order to reduce cooling loads the next day.

COST-EFFECTIVE COMMERCIAL CONSTRUCTION

In its first year of operation, the building's estimated consumption is approximately 36,000 BTUs per square foot, compared with normal energy consumption for similar space in the Sheboygan area of 60,000-90,000 BTUs per square foot per year.

"AXESS" ENERGY ANALYSIS

Upon completion of the construction documents, Syska & Hennessy's Information Systems division conducted an energy analysis using imput data from Donohue's design calculations as well as the original construction documents (i.e., specifications and working drawings). Usage profiles for all interior lighting, occupancy, elevator exhaust fans, and domestic hot water were as per Standard Building Operating Conditions for office buildings (as established by Department of Energy for its Building Energy Performance Standards project). These profiles are printed on the input report. Operating schedules for air handling systems were as per the same Standard Building Operating Conditions for office buildings.

The upper level office area with south-facing skylights and daylight control was assumed to have natural lighting from 9:00 a.m. to 3:00 p.m., and no artificial lighting was needed during this period. The lighting profile for this area has been modified to reflect this assumption. For heating and cooling calculations, south-facing skylights were simulated as south-facing vertical windows. Daylighting was simulated using a special profile that provides reduction in artificial lighting as a function of solar intensity on a horizontal surface.

Solar storage tubes were simulated by accounting for the thermal storage capacity and adding the storage capacity of the zone served by the tubes. The building's peak domestic hot water load was determined using the procedure defined in ASHRAE Handbook, Systems Vol., 1980.

The overall U-factor used for glass was 0.44. The building has double and triple glazing with U-factors of 0.49 and 0.39, respecitively. Insulating curtains and louvers for windows and skylights were assumed to be in effect during winter nights only.

During the heating season, the deck temperature for the variable air volume system was reset by outdoor air to a maximum of 62 degrees Fahrenheit corresponding to an outdoor temperature of 55 degrees Fahrenheit. The heating season was assumed to be in effect from October 1 through March 31.

Input Data Summary	
Gross Floor Area	25,154 SF
Total Wall Area	12,102 SF
Total Glass Area	2,934 SF
Total Roof Area	13,233 SF

The computer program (AXESS) was based on the input data and various assumptions identified below:

BUILDING AVERAGE U-FACTORS:	
Window	0.440
Wall	0.060
Roof	0.044

INDOOR CONDITIONS:	
Summer	78°F, 50% RH
Winter	
Occupied	68°F
Unoccupied	63°F

NO. OF CONDITIONED ZONES: 17

PRIMARY SYSTEMS:	
Electric. Centrifugal Chiller	67.9 Tons
Gas-Fired Boiler	950 MBH
Domestic HW Heater	30.8 MBH

AIR HANDLING SYSTEMS:	
VAV with Reheat:	29.84 KW
Cabinet and Unit Heaters	1.12 KW

Summary: Results

YEARLY TOTAL CONSUMPTIONS:	
Total Energy	35,866 BTU/GSF
Total HVAC Energy	19,298 BTU/GSF
Total Electricity	195,143 KWH
Total HVAC (Electricity)	87,510 KWH
Total Gas	236,186 CF
Total Lighting	83,666 KWH
Chiller (Electricity)	19,109 KWH

References

Daryanani, S., "Design Strategies - Energy and Big Building Design," Philadelphia, 1981, pg. 13.

Mehta, L., "Energy Analysis of Sheboygan Office Building," New York, 1981, pp. 5.

COMMENTS:

This project was given extensive coverage because of the comprehensive application of passive solar design techniques with respect to a building project. The designers went to extraordinary lengths to produce an energy efficient and serviceable project. The nature and extent of these energy-related elements raises the issue as to their combined impact on the architectural character of the office addition. The building does not appear to derive a particular quality responding to its careful thermal performance design. It appears to be, at least from the exterior, a typical straightforward commercial structure. While restrained treatment of solar and passive design elements is always to be desired, it has to be questioned whether something more might have been done to be more expressive of the buildings' many intelligent energy-conserving design concepts.

Waukesha State Office Building

By the Zimmerman Design Group with Howard Needles Tammen and Bergendoff

This district office building was built near the downtown business area in Waukesha, Wisconsin, to consolidate several agencies of the State: DILHR-Petro Inspection, Hygiene, Safety and Building Inspection, and Job Services; Health and Social Services-Community Services, Corrections, and Vocational Rehabilitation; and Revenue which are now located in rental spaces throughout the Waukesha and Milwaukee County areas. Also, the building will house several departments of the Department of Transportation including their design and administrative staff.

The Zimmerman Design Group was retained to prepare proposals for a structure which would consolidate these various agencies within an attractive and thermally efficient configuration. Retained as the subconsultant on the project, Howard Needles Tammen & Bergendoff (HNTB) provided initial site analysis as well as total engineering design services.

DESIGN CONCEPT

The building contains three floors of office space with a fourth floor used for mechanical equipment and storage. A four-story vertical lightwell divides the building, providing natural light to interior spaces and serving as the main building lobby and circulation area. (see site plan)

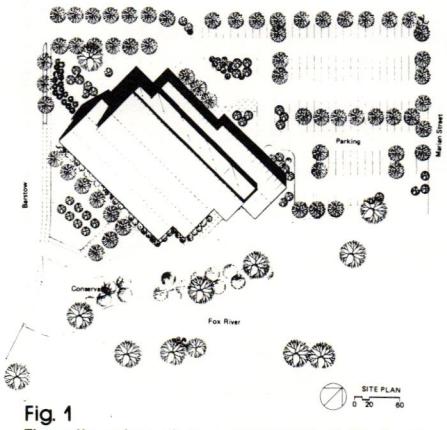


Fig. 1
The site plan shows a remarkably simple building configuration positioned to take maximum advantage of south orientation along the Fox River.

The building employs several innovative energy saving concepts including heavy use of daylighting and automatic dimming, a system of incremental water source heat pumps, and a total building management system which monitors building performance.

Natural light is provided to all major circulation routes and workspaces through the use of a step-back roof design and the incorporation of the lightwell. (see cross section) Large over-hangs on the south side protect the windows from direct summer sun, yet permit penetration during the winter providing warmth to interior spaces. The reflective metal roof provides a specular surface which bounces direct sunlight into work areas while restricting solar heat gain or offensive glare. Solex glass windows allow maximum natural light penetration and minimum glare. This, in conjunction with the fluorescent linear parabolic lighting system, provides efficient artificial lighting as needed. Light sensors located in the work spaces around the building's perimeter offer uniform lighting under all daylight conditions by automatically dimming or increasing fluorescent light to appropriate levels.

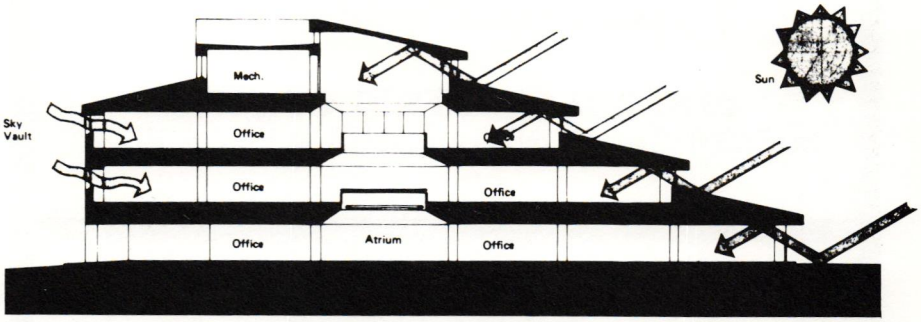


Fig. 2
The cross-section is designed to maximize both solar access and natural daylight to all interior offices. Note small window area provided on north elevation.

Fig. 3
The south view of the State Office Building - a refreshing departure from the standard structure which has come to represent institutional buildings in Wisconsin.

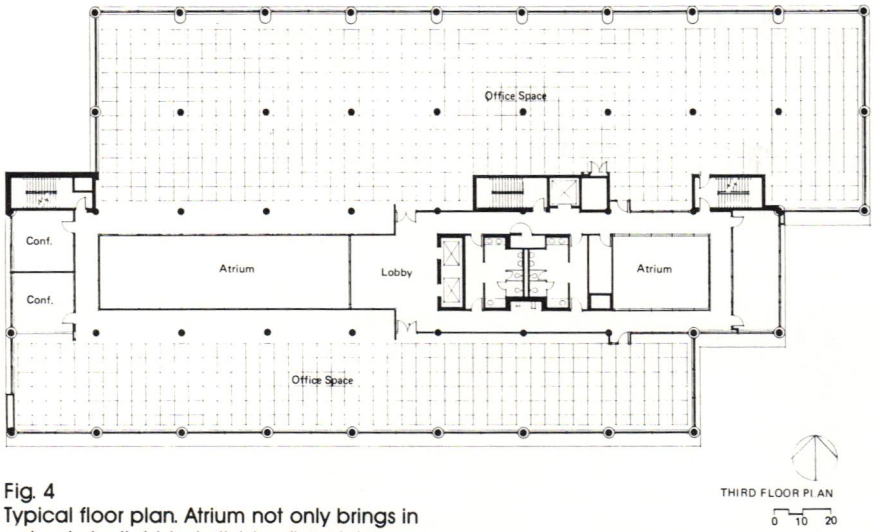


Fig. 4
Typical floor plan. Atrium not only brings in natural daylight but divides floor into serviceable areas, all relatively close to an exterior wall.

Another effective energy-saving technique used in the design of the Waukesha State Office Building is the air-to-water, water-to-air heat pump system. The basic principle of the heat pump system, selected because of its overall efficiency and low operating cost, is to borrow heat from a warm area and transfer it to a cooler one. This is accomplished by an interior/exterior water pipe loop system installed throughout the building. A 30,000 gallon water storage tank holds excess heat which is used during nighttime hours to maintain adequate temperature settings.

Controlling these contemporary energy-saving devices is a computerized total building management system. From one central control area, the entire building's mechanical, electrical, security and fire protection system are maintained and adjusted as required. This innovative system automatically operates heat and cooling storage changeovers and optimizes heat pump loop temperatures. The system is capable of restoring individual work spaces to comfortable lighting and temperature levels while other areas of the building are unoccupied.

The designers project a modest operating budget for the State Office Building.

COMMENTS:

This project is particularly noteworthy with respect to the development of its cross section which serves to alter a rather straight-forward plan organization and produce a well-controlled and mature building. The atrium lends distinction as well as thermal efficiency to this building type which is often treated in sterile and bureaucratic terms. The State is to be congratulated as well as the designers for its willingness to explore non-traditional methods of building.

Fig. 5
Interior atrium used for reception/waiting as well as natural light access to interior offices.

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COMPARATIVE SPANS[1]

	Sheathing Thickness	Oxboard and Plywood	Waferboard
3/8"	Sheathing – span index	24/0	NA
	Max. roof span/no clips	20	NA
7/16"	Sheathing – span index	24/16	24/0
	Max. roof span/no clips	24	16
1/2"	Sheathing – span index	32/16	24/16
	Max. roof span/no clips	28	24
5/8"[2]	Sheathing – span index	40/20	NA
3/4"[2]	Sheathing – span index	48/24	NA

1 – Left-hand number is maximum recommmended spacing of roof framing in inches. Right-hand number is maximum span between floor joists.
2 – 5/8" and 3/4" Oxboard panels are APA certified for Sturd-I-Floor applications with the same span ratings as plywood.

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Brillion Community Center
Brillion, WI

By Somervile Associates, Architects & Engineers
Green Bay, Wisconsin

The Brillion Community Center, which was completed in 1970, consists of 40,000 s.f. of space for a swimming pool, gymnastics, youth recreation room, meeting rooms, kitchen and office space.

Upon completion of the following two inter-related problems became evident and increased in severity over time:

1. Moisture-condensation related problems.

2. Excessively high energy consumption.

Both of these problems were attributed to the use of single glazing for large window and skylight areas and less than adequate insulation in some areas. Moisture problems were intensified due to the use of finish materials unable to withstand moisture presence and the lack of a vapor barrier between the pool and other areas. Without vapor barriers moisture was permitted to permeate the entire building, condense on cold surfaces and cause serious damage. The excess air roof ventilator was not connected to the pool air handling system, allowing moist air to escape to surrounding building areas. In addition, the lack of sound absorbing materials in the pool area created extremely unpleasant noise levels.

In 1978, John E. Somerville Associates was retained to recommend solutions and provide required architectural and engineering services for renovation. These problems were addressed by implementing the following modifications:

1. The original air handling units were abandoned as unsuitable. A new air handling unit, outdoor air intake and excess air roof ventilator were installed with all components interconnected with duckwork. Migration of moisture out of the pool was minimized by providing a negative pressure condition and a vapor barrier between pool and adjacent areas.

2. Replacement of single glazed skylights with 2" thick metal encased urethane panels.

3. Installation of vapor barriers and additional insulation in pool area covered with portland cement plaster and ceramic tile wainscot.

4. Installation of additional roof insulation and new membrane roofing.

5. Installation of energy efficient light fixtures in gymnastics room and pools.

6. Reduction of noise levels by installation of a sound absorbant ceiling.

Fig. 1
Brillion Community Center as originally constructed. Swimming pool produced high level of moisture leading to deterioration and excessive heat loss.

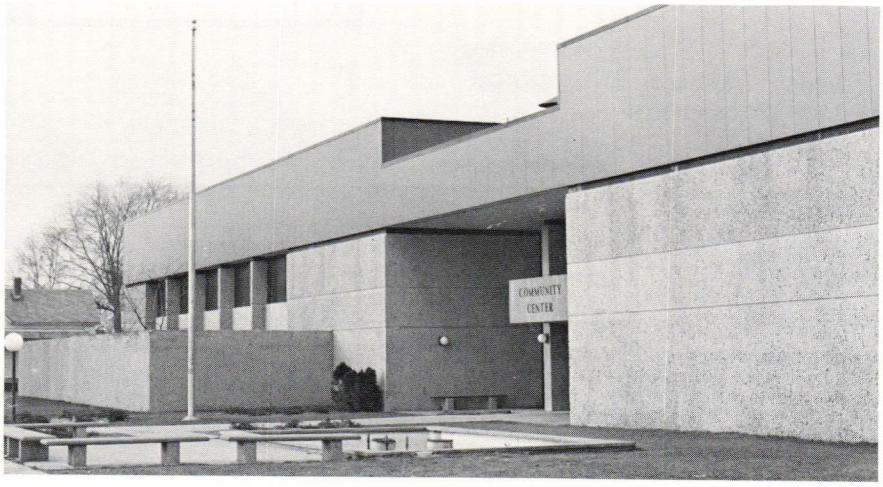


Fig. 2
Brillion Center after alterations to improve moisture migration and overall building performance.

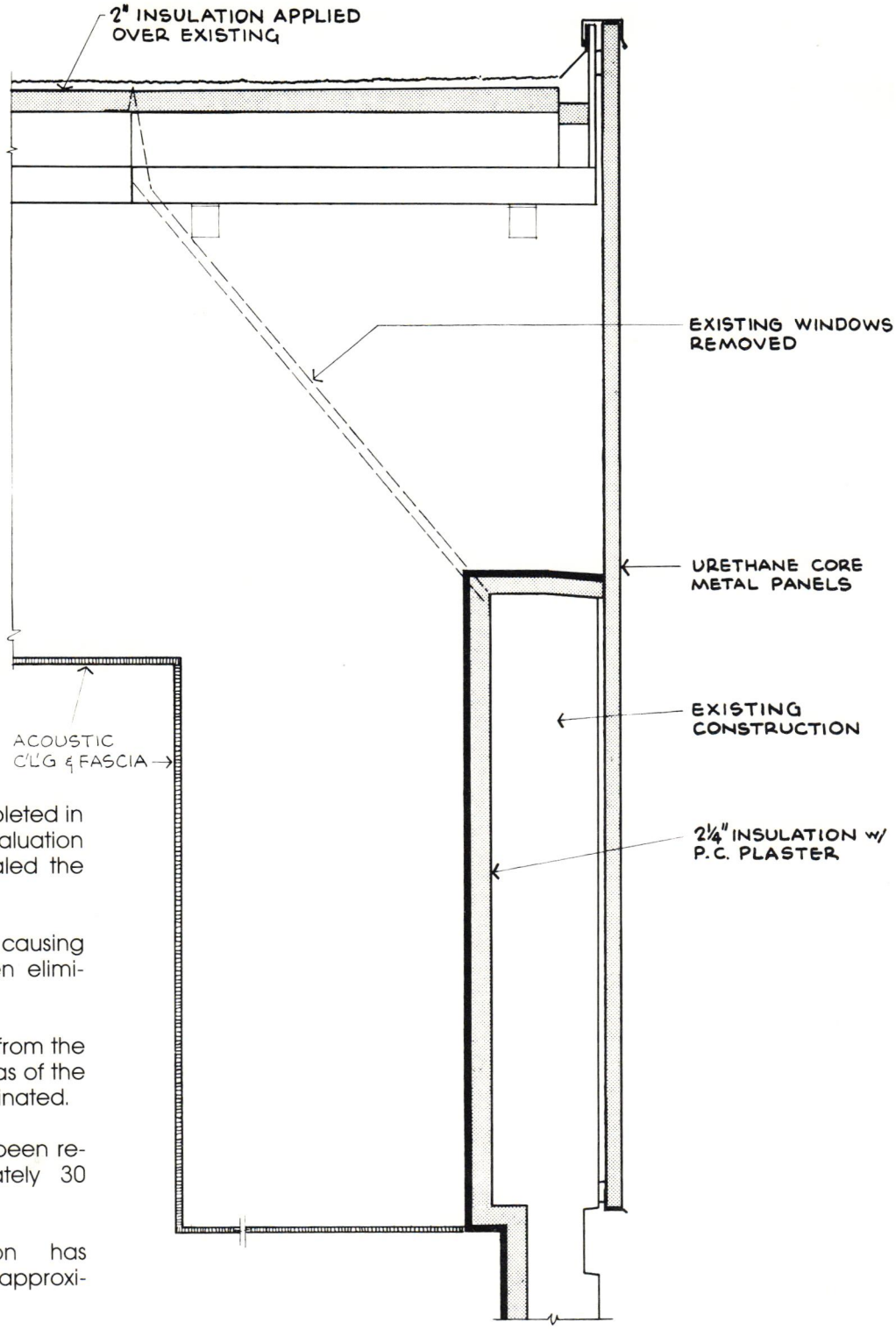


Fig. 3
New urethane core metal panels added at exterior transformed building appearance as well as substantially improved thermal performance of the Center.

The above work was completed in 1979. Post-occupancy evaluation of the building has revealed the following results.

1. Formation of damage causing condensation has been eliminated.
2. Migration of humid air from the pool into the other areas of the building has been eliminated.
3. Gas consumption has been reduced by approximately 30 percent.
4. Electrical consumption has been reduced by approximately 11 percent.
5. Improved pool environment due to noise reduction.

COMMENTS:

This project is instructive for design conscious architcts in several respects. First of all, it underlines the lugubrious fact that many relatively new structures require alterations to increase thermal performance. It also illustrates the powerful impact that even modest changes can have on overall building character. Note how, in this case, the addition of flush metal panels along the eave has virtually transformed the building in appearnce and scale. Whether these changes are consistent with the original architectural intentions is moot. What is clear is that energy-related architectural elements can dramatically alter designs and require product application from an aesthetic as well as thermal performance standpoint.

Girl Scout Building - La Crosse, Wisconsin

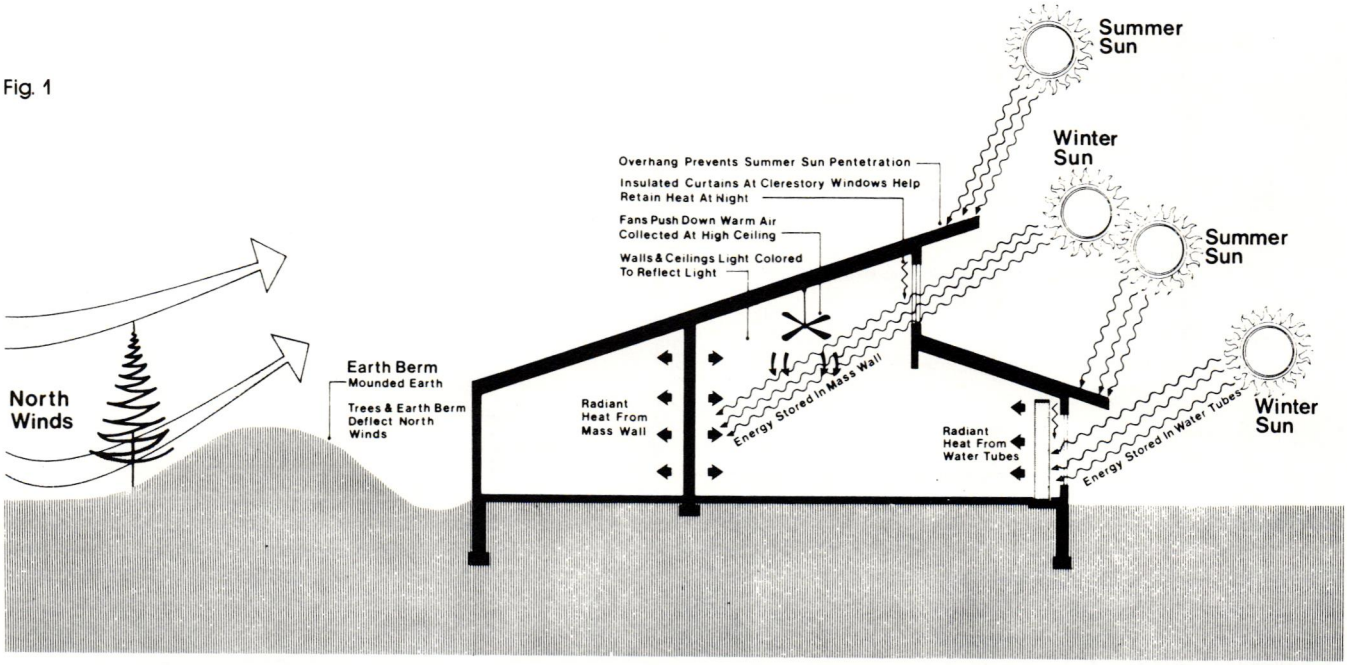
By HRS and Associates, La Crosse, Wisconsin

The new Girl Scout Headquarters Building was designed to use 50% less energy than a conventional building of similar size. Primary energy-saving features include the following:

1) Direct gain passive solar system.
2) Water wall/water tube passive solar system.
3) Earth berming.
4) Insulating window shades.
5) Heat and moisture recovery from greenhouse.

In Section A it will be noted that the open office area contains the entire range of passive design concepts which have become standard in our profession: mass storage wall, thermostat-activated roof fans, night-insulated clerestories and water tube radiant storage for nighttime re-radiation. The straightforward use of these, by now familiar, devices provides an otherwise bland space with character and definition.

Fig. 1



Section 'A'

In addition, the building serves an educational purpose, relative to energy; mechanical systems are exposed and identified to teach Girl Scouts how passive solar energy operates within the building.

The structure is a modest 5,000 square feet, the size of several residential buildings, but manages to incorporate a number of elements derived from energy considerations which lend it a distinctive architectural character.

The entry court, shown on plan and in Section A incorporates a planted area which purportedly serves as an air purification element as well as visual attraction. It is not altogether clear whether an area of vegetation as small can effect the micro-environment as is alleged, but the educational and visual benefits are evident.

Energy utilization recorded between 3/8/82 and 3/7/83 was as follows:

Electricity: 2700 KWH
Natural Gas: 2322 CCF

with a total building area of 5000 sq. ft. unit energy use for the year was:

Electricity:	18,430 Btu/sq. ft./yr.
Natural Gas:	46,440 Btu/sq. ft./yr.
Total	64,870 Btu/sq. ft./yr.

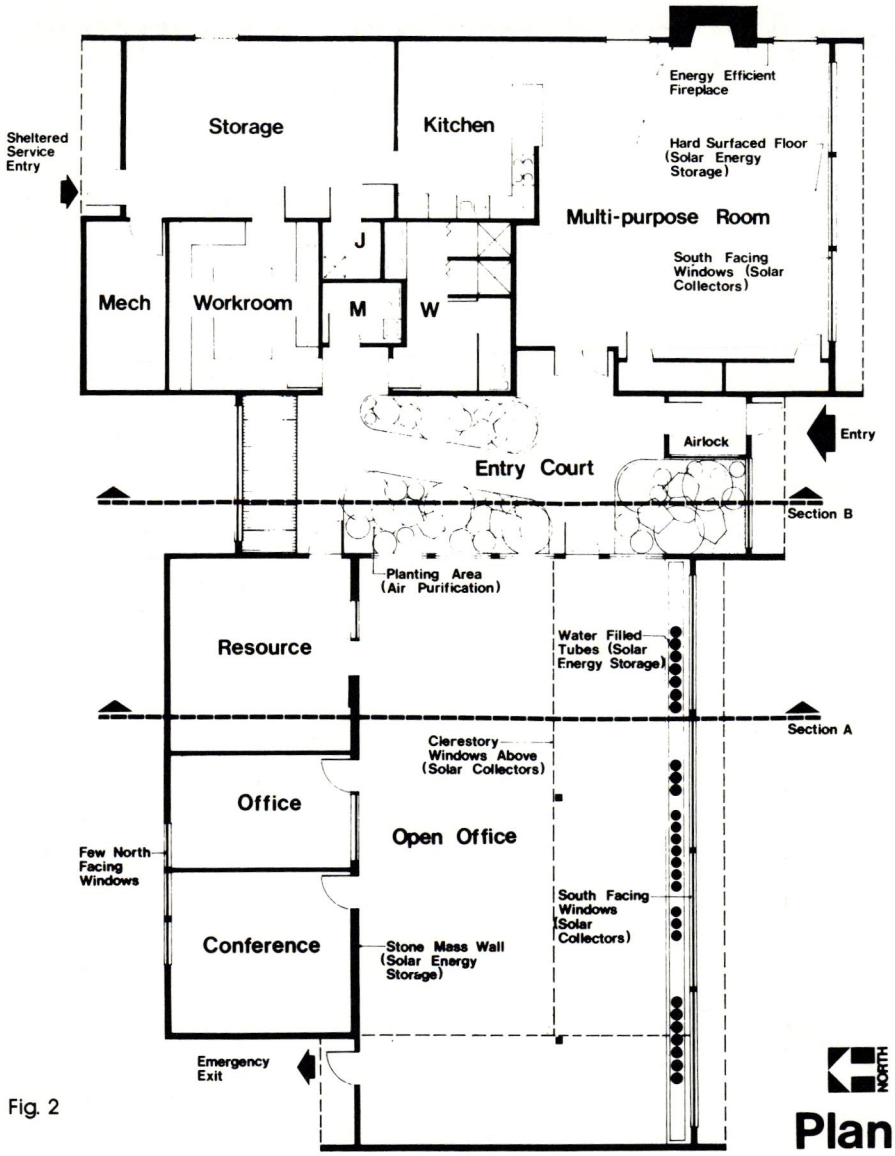


Fig. 2

Plan

COMMENTS:

While the building is well designed with respect to circulation and plan organization the exterior building is straightforward to the point of being anonymous in character. Perhaps this may be viewed as an asset insofar as many modern buildings incorporating energy design features seem to insist on parading them at every opportunity. This project would seem to suggest that it is possible to incorporate thermal efficiency without resorting to architectural heroics. At the same time, a question must be raised as to whether more might not have been made of the many prudent energy-conscious concepts in this project.

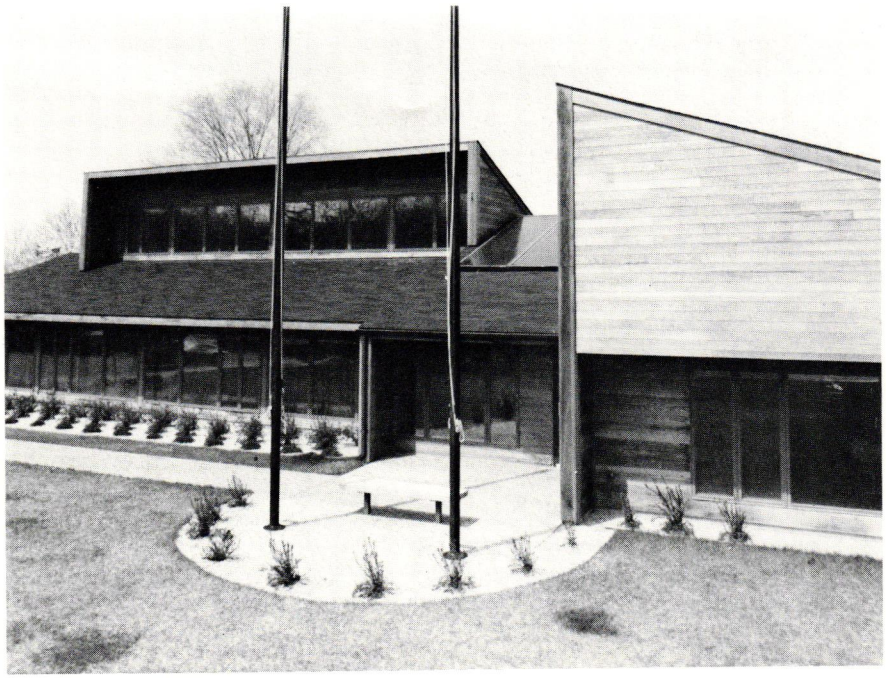


Fig. 3
South viewing of Girl Scout Building showing skylights, and sheltered south facing fenestration.

Eau Claire County Airport Terminal Expansion

By Owen Ayres & Associates - Architects and Engineers

Eau Claire County assumed ownership and operation of the Municipal Airport in 1979. The existing 6,000 square foot terminal building was built in 1954 when operations had seriously outgrown the facility.

The County required additional space for the regular commercial carriers, commuter lines, Federal Aviation Administration operations and airport management offices. In addition, the County wished to include a cocktail lounge, restaurant and coffee shop and gift shop area.

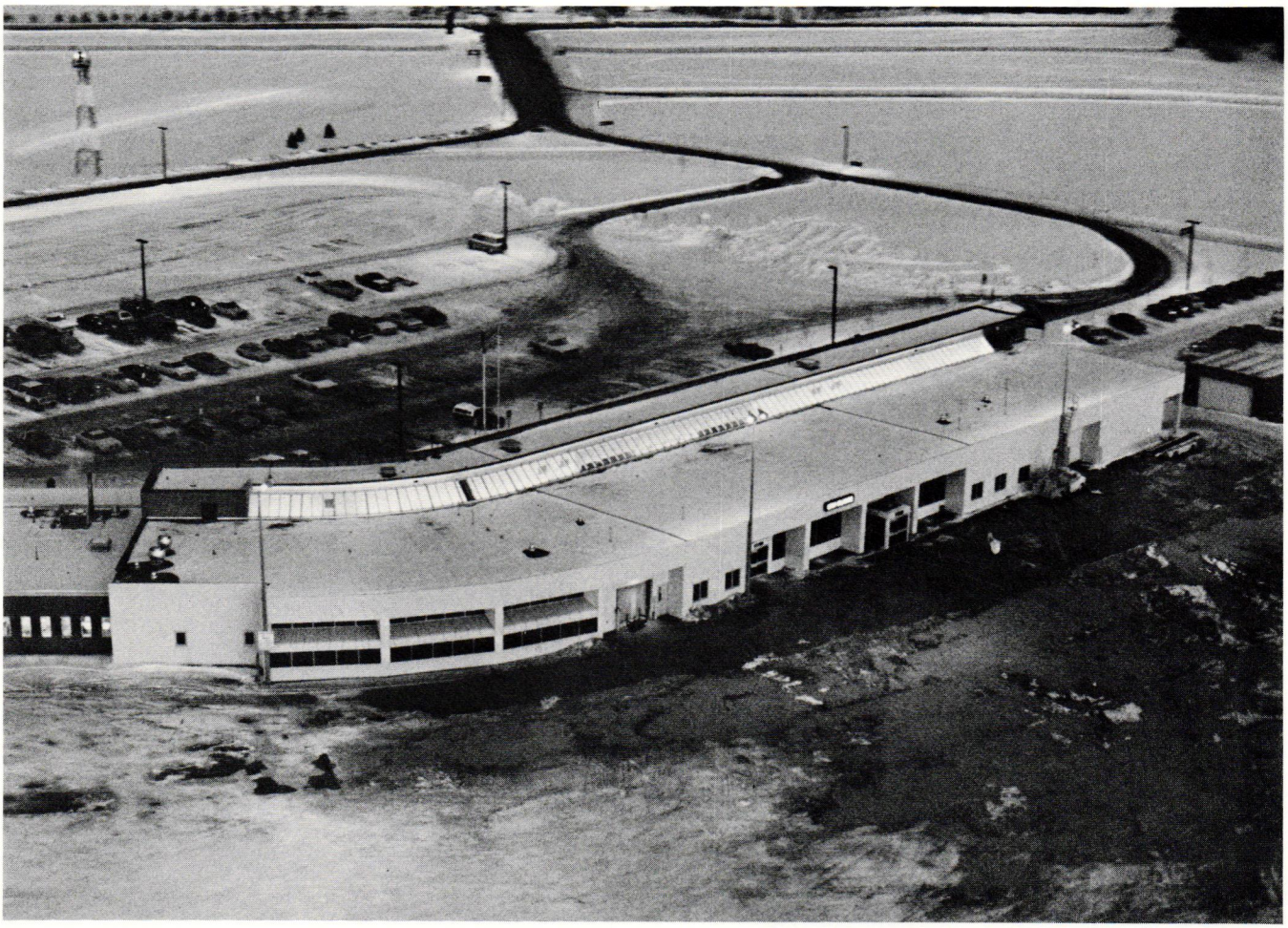
The existing building, though too small, was in good condition and its continued use was a part of the program. Normal airport operations had to be continued uninterrupted during construction. The design goal was to provide a strong building image, appropriately scaled to the site, with a clear differentiation of elements and patterns of movement.

The new terminal building connects directly to the south end of the older terminal, and then curves in response to building limits established from FAA requirements. A continuous canopy connects both old and new portions on the street side. Entry to the new terminal is through a two-story mass which houses a mechanical mezzanine, restrooms and other fixed elements. The large entry portals are scaled to be visible from the entrance road and parking.

Airline operations are housed in the more flexible steel frame and metal clad portion of the building, which is joined to the masonry by a continuous skylight see section at Coffee Shop/Restaurant. This skylight defines the circulation through the length of the building and provides solar heat gain which is picked up and used by the mechanical system.

The response to energy concerns in this project was constrained by program requirements: Integration with the existing terminal building, geometry of runways and taxiways, and various airline and F.A.A. requirements. The building curves as it connects to the existing terminal providing major exposures to the southwest. The northeast elevation is largely closed, with the only major opening at the entry. This approach reduces the adverse effects of northeastern exposure, as well as increasing the visual importance of the main entry.

Fig. 1
Therminal facade contains maximum sheltered south-facing sash in addition to skylight over circulation.



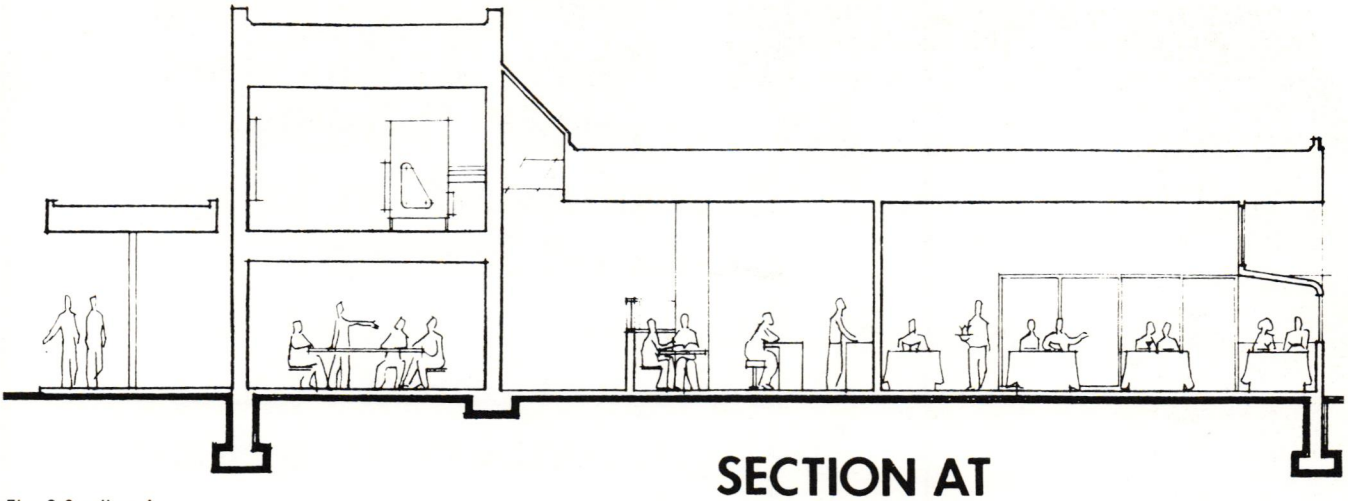


Fig. 2 Section A
Continuous masonry mass alongside of skylight absorbs daytime solar gain for nighttime re-radiation.

SECTION AT COFFEE SHOP/RESTAURANT

Solar gain is achieved within the building from the southwest side in two locations: Low along the exterior wall, and high at the junction of high masonry mass and lower metal clad area.

The admission of solar energy into the building provides some modest heat gain, but natural illumination is also a significant factor in reducing energy use. The photograph of the interior illustrates how the continuous skylight bank, which is quite modest in size, helps to enliven the circulation route and define the various zones within the structure.

The H.V.A.C. system consists of a series of water to air heat pumps. A water line loops the building, connecting these heat pumps. A heat pump either extracts heat from the loop, or dumps heat into the loop, depending on the requirements of the zones served by the heat pump. Hence, for much of the year, the building is provided with heat from solar or internal gains. An electric boiler provides additional heat when gains from solar and/or internal gains do not satisfy building heating requirements. This boiler has sufficient storage capacity so that it can be operated at off peak hours, substantially reducing energy costs.

Fig. 3
Interior circulation path is naturally lit from continuous skylight which parallels masonry storage walls.

COMMENTS:

This project although modest in scale and scope is commendable for its reliance on a few well-considered concepts. The positioning of the continuous skylights parallel to the multi-storied masonry wing appears to be appropriate from both an energy and architectural standpoint. As often happens in passive solar design, a sound energy-related decision will have spatial benefits as well.

Composite Operation And Training Facility Wisconsin Air National Guard/Traux Field/Madison, WI

By Flad and Associates of Madison, Inc.
with Affiliated Engineers, Inc. of Madison WI

The project to be designed and constructed is a Composite Operations and Training Facility. This facility is to provide space for three separate functions: administration, dispensary and dining. Each of these areas has specific space requirements and individual patterns of occupancy. The administration area is to be occupied full time during normal duty hours by personnel performing the duties of Wing HQ plus weekend reserve training duty hours. The dispensary is to be utilized primarily during weekend reserve training duty hours but must be capable of full operations, under emergency conditions, independently of the operations and training activities. The dining area is to be utilized primarily during the weekend reserve training duty providing kitchen and dining facilities for three servings of 280 persons each per meal. No future expansion of the facility is anticipated.

This building is to have a maximum building area of 35,650 square feet. This space was allocated to the areas with the administration area of 20,290 square feet, the dispensary area of 6,840 square feet, and the dining area of 8,520 square feet.

SITE CONSIDERATIONS

The building is located at the southern edge of the site to honor existing water and sewer mains and easements which bisect the site in an east-west direction. The building is located at the end of a looped entry drive off Mitchell Street which will be the main road after the construction of the new fence and gate house at the corner of Mitchell and Hoffman Streets.

The loop creates a formal approach to this building which will be the focal point of the new entrance to the Wisconsin Air National Guard base. General parking is located to the west of the entry drive with handicapped and reserved parking at the front of the building. Central and kitchen receiving are serviced from Becker Street to the south. Ambulance parking is located to the south of the dispensary area. An entry plaza with a flagpole and building identification is located at the terminus of the entry loop and provides a formal setting for the lobby entrance. Extensive landscaping will reinforce the siting of the building and visually strengthen the approach drive to the siting of the building. Deciduous shade trees are located along the south of the building to shade the building in the summer. Earth berms will be utilized on all sides of the building to reduce energy consumption and to visually tie the building to the site.

The design criteria outlines energy conservation guidelines for the siting, building envelope, HVAC systems, plumbing and electrical systems for new buildings. The selection of building systems was based on an energy analysis using life cycle costing techniques. This analysis included a calculation of an annual energy budget for this building is approximately 30,000 Btu/sq. ft./yr., which is well below the Department of Defense 70,000 Btu/sq. ft./yr. maximum design energy budget for an office building in Wisconsin.

PLAN

The building developed, in response to the program, as three integrated functional elements. A central two-story element (administration) is flanked by two one-story elements (dining and dispensary) to the east and west. The two-story element will be occupied full time during normal duty hours while the one-story elements will be occupied during the weekend reserve training duty hours. Primary access to all building functions is controlled through the main lobby with secondary entrances to the dining and dispensary to allow those areas to function independent of the lobby. Handicapped access to the building is accomplished with on grade entrances at each element plus an elevator at the lobby of the two-story administration element. Daylight will be introduced into the lobby through the use of barrel vault skylights and into the two-story main corridors by south clerestory windows.

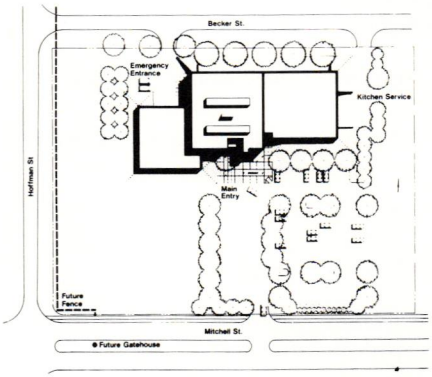


Fig. 1
Site plan shows tri-partite plan with north earth berm sheltering and openings to Becker Street to the south.

The significant energy design features are evident in the Building Cross Section (Figure 1) which includes a multi-story light scoop fac-

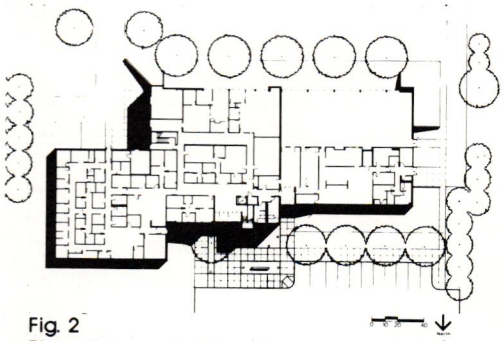


Fig. 2
Plan shows principal office spaces and dining room facing tree-shaded south exposure.

ing south which serve as passive solar collectors and to increase interior natural illumination. The use of partial earth sheltering and employment of narrow strip sash along the south, illustrated in the section through Dining Room (Figure 2) is another major design feature which has important site planning as well as energy implications.

BUILDING THERMAL ENVELOPE

The building envelope is designed to provide cost effective and energy efficient insulation and resistance to transmission and infiltration heat losses. The walls and roofs have thermal resistances of 17 and 25 respectively. Earth berming of the exterior walls provide additional insulation and thermal mass to offset winter heat loss and summer heat gain. The windows are provided with thermal break frames and 1" bronze tinted insulating glass. The building entrances incorporate vestibules, insulated metal doors and insulating glass. The rectangular shape of the building provides a large interior floor area, while minimizing exterior wall surface areas and associated energy losses.

HEATING AND COOLING AND VENTILATION SYSTEMS

The multiple boiler system automatically sequences the operation of the individual boilers and respective hot water pumps to maintain a high seasonal boiler efficiency and reduce energy use. Each boiler has automatic combustion air dampers which open just before burners start and close after burners stop firing. The boiler hot water temperature is reset with outdoor air temperature and the entire boiler system is automatically controlled to shut down at an outdoor air temperature above 60°F (adjustable).

The direct expansion cooling coils with air cooled condensing units serving each air handling unit provide an energy efficient cooling system. The controls do not allow the condensing units to operate when the outside air is below 55°F (adjustable).

Multiple air handling units utilizing energy efficient variable air volume (VAV) systems in all areas except the computer room. The VAV systems provide a varying supply of cooling air to each space, the amount of this air being adjusted automatically to meet the space cooling load. The result is a reduction of energy utilized for fans and elimination of simultaneous heating and cooling of ventilation air. The computer room has a separate unit to handle its strict temperature and humidity requirements.

The use of multiple air handling units allows certain systems serving unoccupied areas of the building to be shut down while those serving occupied areas continue to operate. The ventilation systems incorporate several other energy conserving features which include night shut down; temperature setback; morning pickup; economizer cycles to sue outside air for cooling in lieu of mechanical cooling when conditions permit; and high efficiency fan motors.

The kitchen exhaust system utilizes energy efficient slot-type exhaust hoods. These hoods capture cooking odors and heat with a high velocity air stream while reducing total air flow required by a conventional hood.

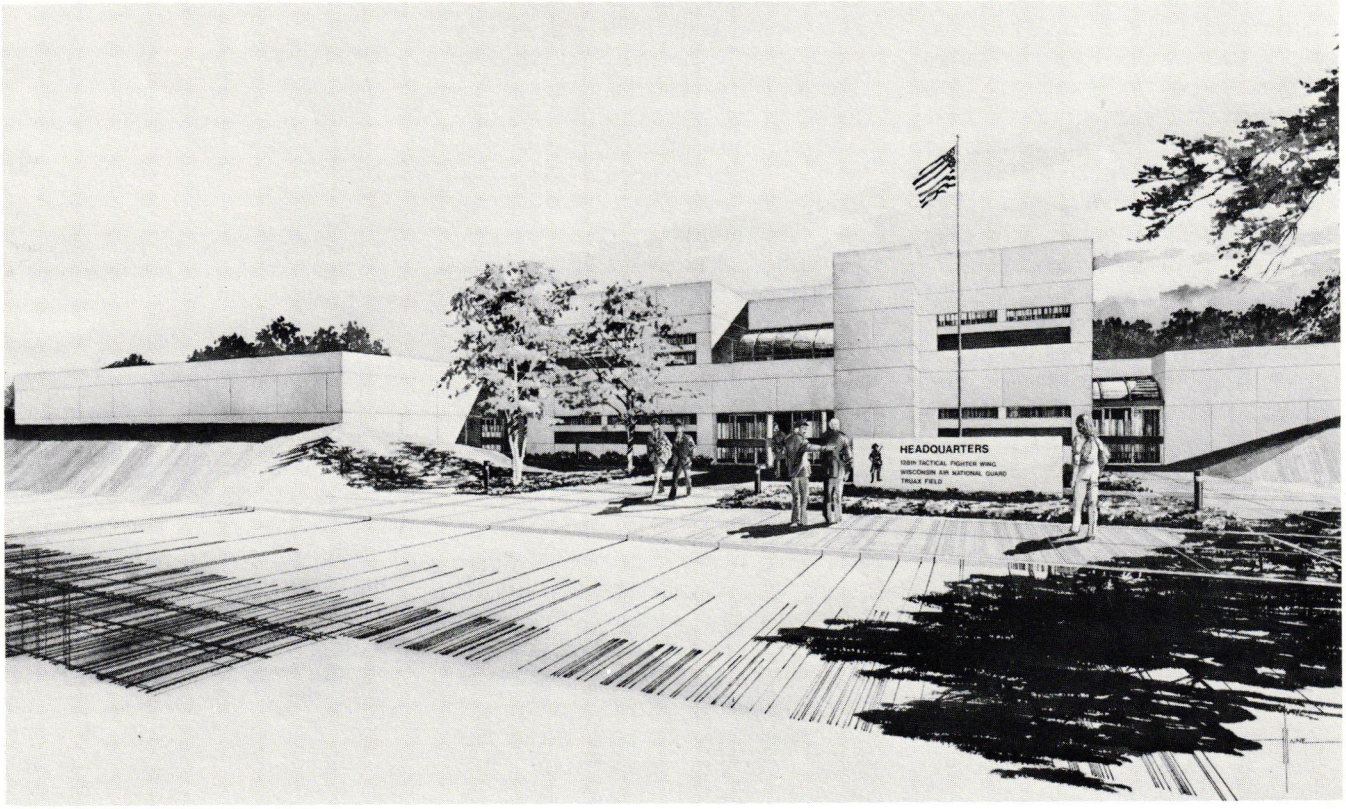


Fig. 3
Approach to Headquarters Building from north. Note minimal treatment of fenestration and earth berming to increase thermal efficiency.

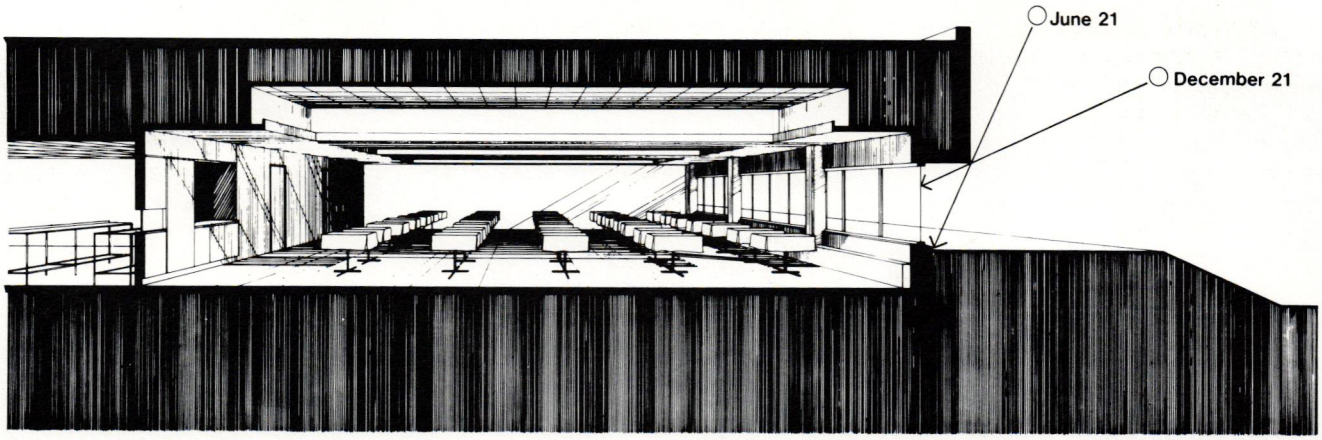


Fig. 4

LIGHTING AND ELECTRICAL SYSTEMS

Energy efficient fluorescent and HID light sources will be used to take advantage of their high lumens per watt ratios. Other electrical equipment including ballasts and motors have been specified to maintain high power factors and high energy efficiency.

DOMESTIC HOT WATER HEATING

A solar energy system utilizing 120 sq. ft. of collector area will preheat domestic hot water. Conventional water heaters will provide the majority of the 120°F building domestic hot water. The low temperature hot water, 120°F, will result in reduced pipe heat loss. Where higher temperature water is necessary, as in the kitchen, booster heaters located near the point of use will be provided. The domestic hot water circulating pump will be controlled by a 7-day clock set to operate during occupied times which will further reduce energy losses.

The Headquarters building prudently minimizes north facing glass, eliminating it altogether in the one story wing elements and using narrow strips in the offices. The sole departure from this single-minded energy-conscious approach can be seen in the north-facing skylight at the entry lobby (see Figure 1). This contradiction generated by mutually conflicting desires is common to energy-conscious architectural designers who, in attempting to balance design considerations, of necessity have to concede some aspect of idealized thermal performance. This north-facing skylight clearly provides natural daylighting and visual amenity to the entrance, probably with an energy deficit considering nighttime heat loss to the sky plane. On the other hand overall building performance appears to be quite favorable, suggesting that vigorous energy performance in one portion of the building might allow for modest relaxation of constraints in other for the sake of traditional architectural concerns.

COMMENTS:

This otherwise typical institutional building and site are given added architectural character by virtue of energy considerations early in the design process. It is significant, as well, that an agency such as the Air National Guard, which might reasonably be expected to be a conservative client, mandates excellent energy performance and is willing to accept departure from traditional architectural design approaches in order to achieve this.

This building demonstrates a facet of architectural design which is becoming clearer as firms become more energy-conscious. Incorporation of thermal performance considerations as a major programming factor is not only sensible in terms of life cycle costing but can generate the major architectural form determinants for building projects.

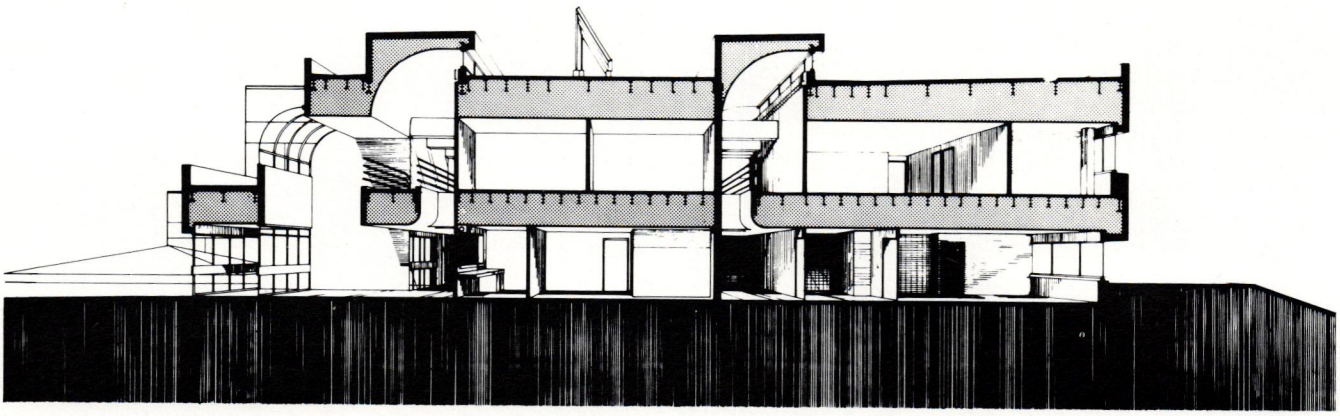
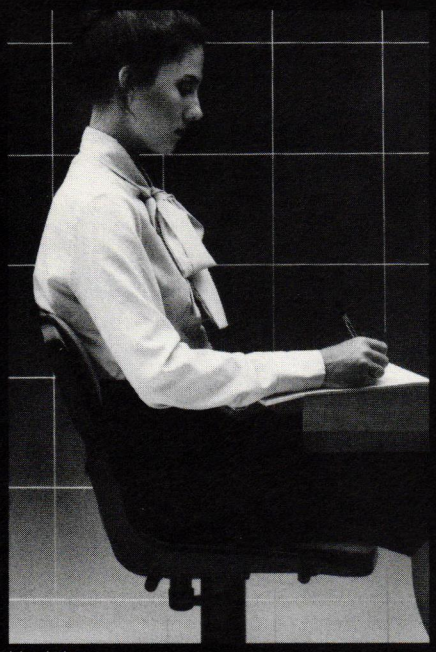
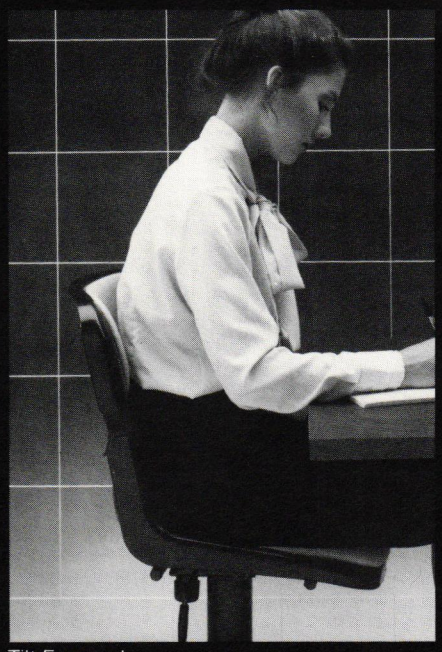


Fig. 5
Section thru headquarters illustrates multi-storied south facing skylights over circulation areas. Note collectors for domestic hot water as well as passive collection features such as earth berming and thermal mass storage.



Upright

Relax



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Designed and developed by
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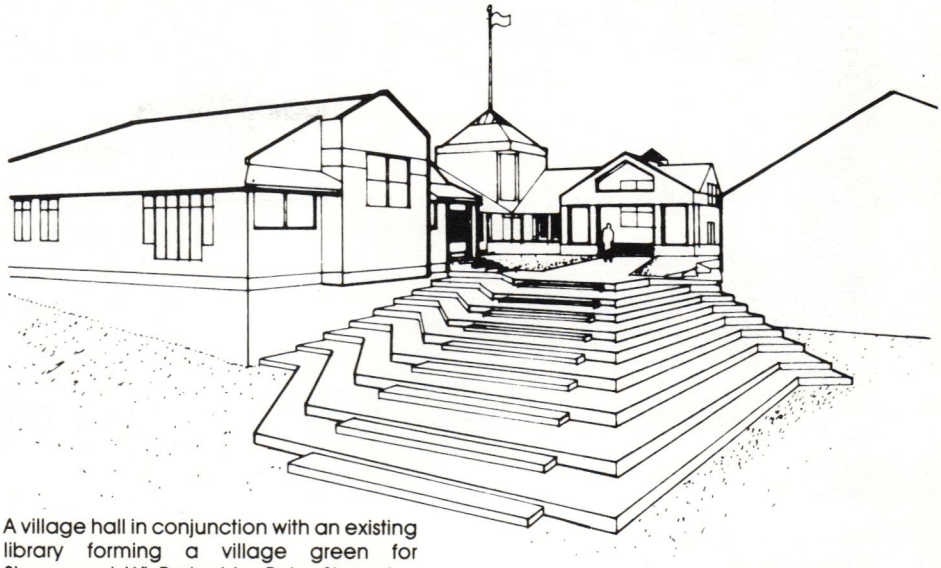
Objectives Of Studio Work In Energy Conscious Design

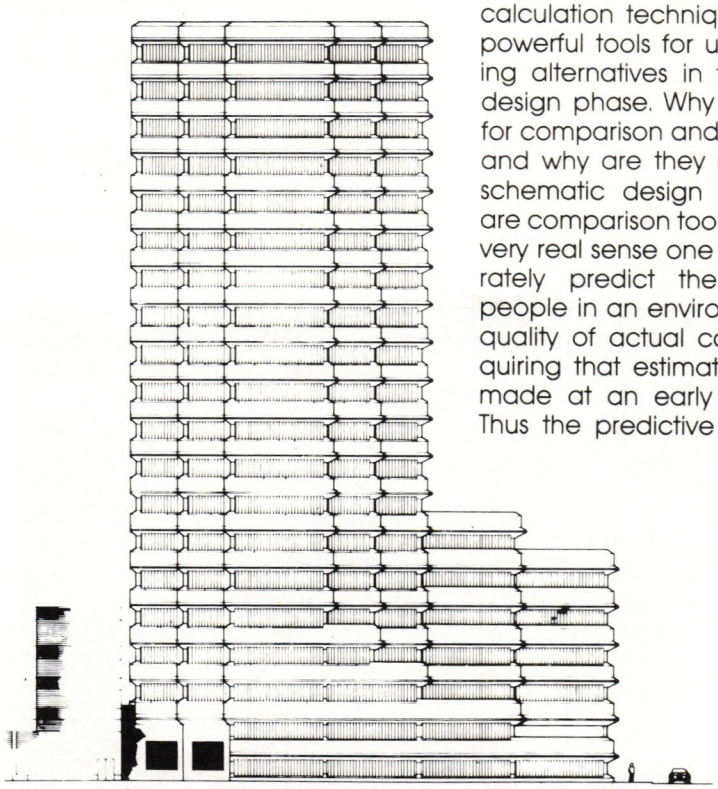
By Frederick Jules, Associate Professor

Studio applications involving energy conscious design are improving annually in direct proportion to increasing strength of applicable methodologies and a clearer sense of their application in a design process. Our design studio concentrates on developing skills in ordering functional spaces, developing place and symbol, fitting the building to its context, selecting appropriate structure and construction systems, and controlling the thermal, auditory and other sensory environments. On particular projects, each of the above issues would have a relative importance based on how difficult the issue is to integrate with the others and the specifics of program and site. Concern for conserving energy is simply another issue with varying degrees of importance in the design process as it affects final project form. This is a subtle concept to impart to students. Buildings do not have to incorporate obvious solar artifacts to conserve energy nor does a strategy of conservation necessarily dominate a design process.



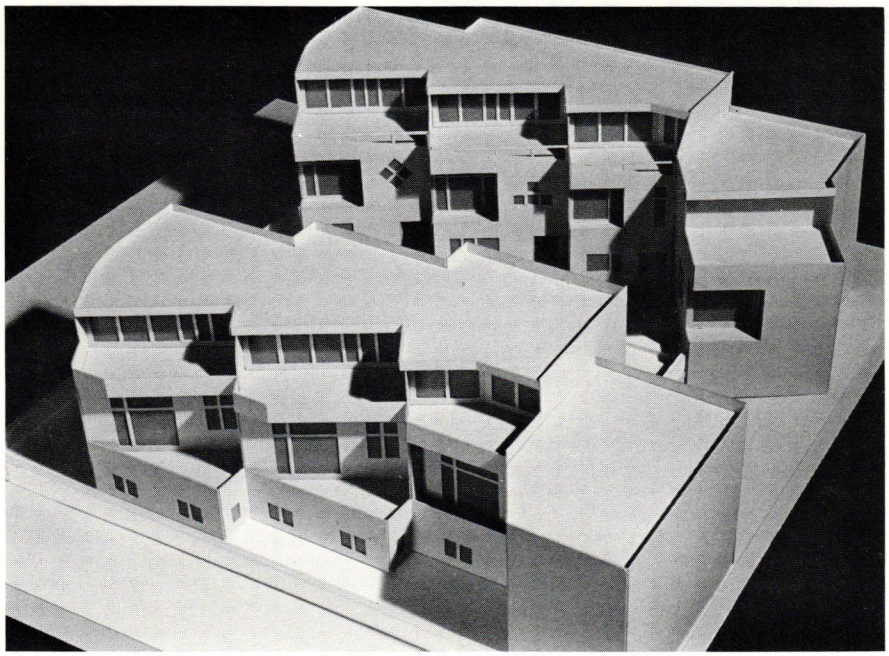
A village hall in conjunction with an existing library forming a village green for Shorewood, WI. Project by Peter Stewart.

To stress the appropriate integration of energy conserving strategies within a traditional studio course format the school has employed two recently developed calculation techniques which are powerful tools for use in comparing alternatives in the schematic design phase. Why are they tools for comparison and not prediction and why are they applied in the schematic design phase? These are comparison tools because in a very real sense one can not accurately predict the behavior of people in an environment nor the quality of actual construction, requiring that estimates of both be made at an early design stage. Thus the predictive power of the methodology is dependent on estimates which cannot be accurately determined. However, if the estimates are set at the same level for two alternatives, comparison between designs may be developed which can predict relative performance. The tools have great value at the schematic design phase because it is at this point in the design process that major form decisions are made. Designers need to know whether a particular configuration has the potential for effective use of solar energy and whether the entire configuration is relatively energy conserving. It is at this phase that one can ascertain the relative importance of energy conservation in relation to particular form changes which can vary a great deal with program and packing of the functions. In some cases it has great importance and in others it is marginal. The tools can predict the relative importance in energy terms of different schematic design approaches. They also address the issues of construction and material selection as well as the location and amount of openings in the structure for light, view, and ventilation at a preliminary stage.



A speculative Office building for a site behind the Grand Avenue Mall facing Zeidler Park in Milwaukee. Project by Mark Wade.

Techniques used at Wisconsin have been developed by Professor Michael Utzinger. The one first used involves the use of Passive Solar



High density, low-rise housing at 20 units/acre for an urban site with a view of Lake Michigan. Project by J.T. Heater.

Design Charts for Wisconsin developed on a grant from the Wisconsin Concrete & Products Association and is useful on residential scale projects (Wisconsin Architect, August 82 pp 26-67). The second methodology is one Professor Utzinger developed this year and has not yet been published. It is an energy balance methodology similar to the Energy Graphics methods prepared by Booz Allen Hamilton for DOE (PA 4:82 p. 177) which we utilized last year. The essential difference between Professor Utzinger's method and the Energy Graphics one is that Professor Utzinger's method is faster and after some preliminary calculations alternatives can be compared quickly with much less recalculation.

To demonstrate the wide range of impact of energy conservation strategies on particular building types, students are assigned two projects each semester utilizing one methodology on the first and the other on the second. For each project, students are given the choice of two programs and sites resulting in a wide range of solutions which provides the basis for a general discussion comparing the effects of program and building type in relation to effectiveness of various conservation strategies.

The programs available for this first project this year were a 20 story speculative office building and a village hall on which the energy balance methodology was applied. The programs for the second project were high-density, low-rise housing (20 U/A) and a lowrise hotel utilizing the Passive Solar Design Charts methodology.

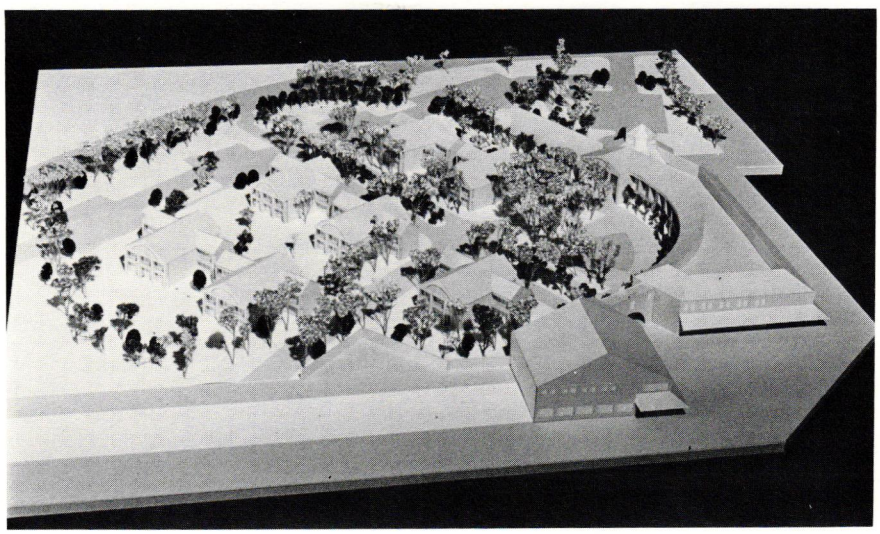
The comparison between schemes were interesting and informative. The speculative offices were greatly affected by shading and lighting control while the village halls were affected by surface area, construction type and collector area. The housing, because of its density was not as subject to orientation as might be supposed and was affected instead most by shading from adjacent units. In general, siting issues and opportunities prevailed as principal form determinants on those projects. Hotel designs because of the complex variables illustrated showed that room orientation as much as 60 degrees from south could still be effective in terms of energy conservation, and that variation of surface area could also be easily accommodated.

In conclusion, our energy conscious design study continues to provide opportunity for comparison of energy conservation strategies and the development of sensitivity to the relative importance on these strategies in the building design process.

Special thanks are given to the followings students for inclusion of their work in this article:

Speculative Office: Mark Wade
Village Hall: Peter Stewart
Housing: J.T. Heater
Hotel: Kurt Wibbenmeyer

If there is one point to the work it is that each design situation is different and requires its own analysis and judgments. From the broad range of work undertaken this year several clear facts emerge: First, each building type, program and siting situation is unique and requires individual analysis. More importantly, the early analysis of building form in relation to thermal performance can be a potent design tool.



A hotel and marina facilities for the Milwaukee Lakefront is in response to a program by the Milwaukee County Park Commission. Project by Kurt Wibbenmeyer.

Architecture - The Key To Our Energy Future

By Jim Dorr

Over the last 5 years Jim Dorr has served as an energy consultant and as director of the Wisconsin Energy Extension Service (WEES) at the School of Architecture and Urban Planning, University of Wisconsin - Milwaukee. WEES received national recognition for its energy conservation program in public buildings from the program's Washington office and a national award from the National Association of counties for work on the Fond du Lac County Energy Management Plan for the 1980's. In 5 years WEES provided technical and organizational assistance on energy matters to more than 50 local governments, hundreds of small and large businesses, and nearly 10,000 homeowners. Due to budget cuts at the federal level, the program was terminated in April of this year.

With the end of the cheap-energy era, architects are facing an enormous potential workload. By the year 2000 millions of buildings in this country will undergo major renovation to improve their energy efficiency. Most of these renovations as well as the designs of new buildings will require the skills of architects and engineers who can design buildings that are responsive to climate. In a recent article for "Solar Age" magazine, Ezra D. Ehrenkrantz, FAIA, describes the situation as follows:

> At the beginning of this century, we were disconnected from a tradition. The combination of new building technologies and cheap, convenient energy removed many architects and builders from their historical concern with the climate function. Image began to dominate as never before in our large buildings. The architect could make tremendous innovations with a building's appearance and then turn it over to an engineer, saying: "See if you can make this building habitable." The challenge was occasionally so great that it couldn't be done.

Engineers normally met this challenge by specifying lighting, heating, ventilating and cooling systems with enormous capacities, often oversizing them to insure comfort under the most extreme conditions. Today these buildings are rapidly becoming too expensive to operate. They are a major part of America's energy problem. In order for architects to become part of the solution they must first, understand the problem that exists, second, improve upon their skills in designing for climate/energy and third, begin educating clients and selling this vital skill.

Few events in modern history have had the world-wide political and economic impact of the 1973 Arab oil embargo. During that six month embargo, world crude oil prices quadrupled from $3/barrel to $12/barrel sending the economics of oil importing nations reeling with rampant inflation followed by recession and unemployment. Rapid recovery was made nearly impossible as oil prices continued to rise, nearly tripling again before peaking at $32 in 1980. Experts from the oil industry as well as government speculated at that time that crude oil prices would probably reach $80/barrel by 1985 even if peace and stability were restored to the Persian Gulf. In anticipation of this price, energy corporations and the government began investing billions of dollars in oil shale, coal gasification and other new and expensive resource developments knowing that they could compete with $80 a barrel oil.

Today oil prices have dropped to $29 a barrel and natural gas, coal and other fuels seem to be settling at a similar price plateau ($8-$10 per million btus.) The federal Energy Information Administration projected in May of this year that oil prices would continue to drop to $25 a barrel by 1985 before rebounding to $37 a barrel by 1990 along with economic recovery. Most of the alternative fuel developments now sit idle, either scrapped or on indefinite hold,

Advertisers Index

tying up billions of dollars in non-productive capital investment. No longer is the energy crisis the "Moral Equivalent Of War" (MEOW) as the Carter Administration had advocated. Under the Reagan Administration, the Department of Energy is operating on a small fraction of its former budgets and may be dissolved by the next presidential election. In short the attention of the nation has shifted dramatically from reducing our dependence on imported fuels, to offsetting their effect namely, inflation and unemployment. The energy crisis has not gone away. We are just seeing it differently.

Unfortunately many of the conditions existing in 1973 which made the United States so volnerable to the Arab oil embargo, still exist today. We are still heavily dependent on foreign sources of oil and gas, many in politically unstable regions of the world. Despite tremendous expansion of exploration, domestic production of oil and natural gas continue the decline which began in the early 1970's. Minor shortages are being predicted for as early as the mid to late 1980's. While we have made great technological strides, the fact remains that no new source of energy is likely to replace today's fossil fuels in either price or versatility in the foreseeable future. Although energy consumption has dropped an average 20 percent in all sectors since 1973, our buildings remain far less efficient than existing technologies and moderate investment will permit.

So what is our "energy future"? Cheap energy is certainly gone at least for the remainder of this cen-

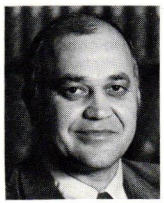
More than one third of the nation's energy is consumed in the heating, ventilating, cooling and lighting of buildings. Products and design techniques are available to cut energy use in existing buildings by one half while at the same time improving the comfort, convenience and reliability. So predictable and enticing are the savings that many of these energy measures have lured manufacturers such as Johnson Controls and Honeywell to invest their own resources in the products that they install for a share of the savings. There are also third party investors such as Scallop (a Shell Oil subsidiary) and smaller firms like Milwaukee's own Syncon Inc. which will propose and install energy saving measures for a share of the savings. The creative application of these energy savings ideas throughout millions of individual buildings, sensibly and cost effectively, will require architects who are able to integrate climate/energy design skills with their ordinary professional services.

The architects who meet this challenge will provide work not only for themselves, but for millions of workers in the construction and related industries. Furthermore the investment of billions of dollars in more energy efficient buildings will reduce spending on foreign oil and gas, thus reducing the balance of trade deficit and aiding in the economic recovery. In few states will such investments have a greater impact than in Wisconsin which currently imports 96 percent of its energy from other states and abroad. A mere 15 percent of the $7 billion that Wisconsin citizens and businesses pay this year for energy will stay in the State. Improving our energy efficiency by just 15

right amount of massing, insulation, glazing, ventilation and shading to produce comfortable buildings that operate on one-tenth the energy requirements that they have today. It is vital that architects accept their role in our energy future and the time to start reeducating ourselves is right now.

Society News

FAME AND FORTUNE



Frank Dropsho, AIA

Those serious readers of the WISCONSIN ARCHITECT will recall the cover of the June, 1983 issue . . . a photograph of stairs taken by Southwest Chapter President Frank Dropsho, AIA. Frank has reported that the successes associated with this publication have caused him to give serious consideration to obtaining a press agent and relocating to the "Big Apple" (or Baraboo).

You too can have fame and fortune. Submit your projects, photos, essays, drawings, to the WSA office for consideration for publication. We only ask you to remember us "little guys" when your boat comes in.

MEMBERSHIP ACTIONS

OLSON, GERALD T., was approved for AIA Membership in the Southwest Wisconsin Chapter.

SELL, DANIEL, was approved for AIA Membership in the Northeast Wisconsin Chapter.

GARTNER, HOWARD E., was approved for AIA Membership in the Southeast Wisconsin Chapter.

LAMERS, KENNETH L., was approved for AIA Membership in the Southeast Wisconsin Chapter.

CONNOLLY, KEVIN J., was approved for AIA Membership in the Southeast Wisconsin Chapter.

LIABILITY ALERT

The AIA, responding to a court decision has issued a liability alert. This warning involves concrete admixtures. Architects are specifically advised to investigate carefully the chemical components of any admixture to be specified on new projects. A rash of claims involving mortar additives containing vinylidine chloride are being brought against architects. Because admixtures of this type are used often and have been specified in over 1,000 structures since the late 1960's a thorough investigation of the application and potential for deterioration is recommended.

One case against Dow Chemical involves a 23 story structure in Cleveland built in the late 1960's with a full-height, 4 - inch - thick, single layer of facade brick. The brick did not have any block backup and had been set in Dow's Sarabond mortar. Chloride ions from the mortar leached out and attacked the unprotected steelwork behind the brick. The steel rusted, expanding outward against the brickwork and causing it to crack. Eventually, the brick was removed, the steel was cleaned and epoxy-coated, and the brick was reset. The judgment against Dow was for 13 million in costs and 12 million in litigation expenses.

ARBITRATION . . . IS IT COVERED?

Did you know that arbitration is an unacceptable means of dispute resolution for some professional liability insurance carriers??? In other words . . . in some instances an arbitration provision in your agreement is not binding on the liability carrier unless that arbitration clause has been specifically endorsed onto your insurance policy.

The purpose of this notice is not to discuss whether arbitration is an acceptable method of dispute resolution for construction claims. What is important is that you understand whether or not arbitration is or is not an acceptable means of dispute resolution with your current liability insurance carrier. If it's not . . . you could have serious problems since a vast majority of architect-owner agreements contain arbitration clauses.

"ARCHITECTURE TODAY — ARCHITECTURE TOMORROW — FALL LECTURE SERIES

Issues in architecture, contemporary and future, will be the topic of the fall lecture series "Architecture Today — Architecture Tomorrow" being organized and co-sponsored by the Wisconsin Society of Architects Southwest Chapter, the Madison Art Center, and the Elvehjem Museum of Art. Four lectures will be presented by a major architecture critic and three nationally-known architects who will come to Madison, one each month September to December.

Paul Goldberger, architect critic, will present the opening lecture for "Architecture Today — Architecture Tomorrow" on Wednesday, September 21 at 8 p.m. in Room 160 of the Elvehjem.

E. Fay Jones is the speaker on Wednesday, October 26 at 8 p.m. in Room 160 of the Elvehjem. Jones believes that architecture begins with the site. He concedes, "I practice the principles of organic architecture, or what I understand about it." Like Wright, Jones follows the same theme throughout the entire structure, from building details to furniture.

Michael Graves will present a lecture on Wednesday, November 16 at 8 p.m. in the Isthmus Theater of the Madison Civic Center. Michael Graves is one of the most talked about and controversial architects of our time. He has emerged as a prominent theorist and proponent of "Post Modernism". Graves' architectural designs owe much to historic precedents of Classical and Baroque architecture. He boldly uses pastel colors and purely decorative ornamentation. These qualities go against the modernist tradition of simple, unadorned geometric forms typical of skyscrapers, yet Graves also incorporates much of what has been learned from Modernism.

Completing the series will be architect **Stanley Tigerman** on Wednesday, December 7 at 8 p.m. in Room 160 of the Elvehjem. Stanley Tigerman was born in Chicago in 1930 and received his architectural degrees from Yale University. He has had his own architectural practice since 1964 and is the professor of architecture at the University of Illinois at Chicago whre he monitors its journal **Threshold**. Mr. Tigerman is probably most widely known for his infusion of humor and sensuality into his projects. Titling buildings funny names such as "Hot Dog House" and "Tigerman takes a bit out of Keck", he is likely to illustrate their functions by making a parking garage shaped like a car or having a large dog house (the "Bau-Wau House") in the entry way of his Anti-cruelty Society addition in the Mies-revering city of Chicago.

Admission to "Architecture Today — Architecture Tomorrow" is **by subscription**. Tickets for the four lectures are $19 for members of any of the one co-sponsoring institutions and $24 for non-members. Mail checks made payable to the Wisconsin Society of Architects/Southwest Chapter to Dan Murrish, AIA, 570 Hillcrest Drive, Verona, Wisconsin 53593. Please enclose a stamped, self-addressed return envelope. There will be no refunds. Seating is limited, and requests for subscriptions will be honored on a first come, first served basis upon receipt of the fee. Depending upon availability, tickets to individual lectures will be sold for $6.50 each at the door at 7:50 p.m. on a stand-by basis.

PROFESSIONAL SERVICE DIRECTORY