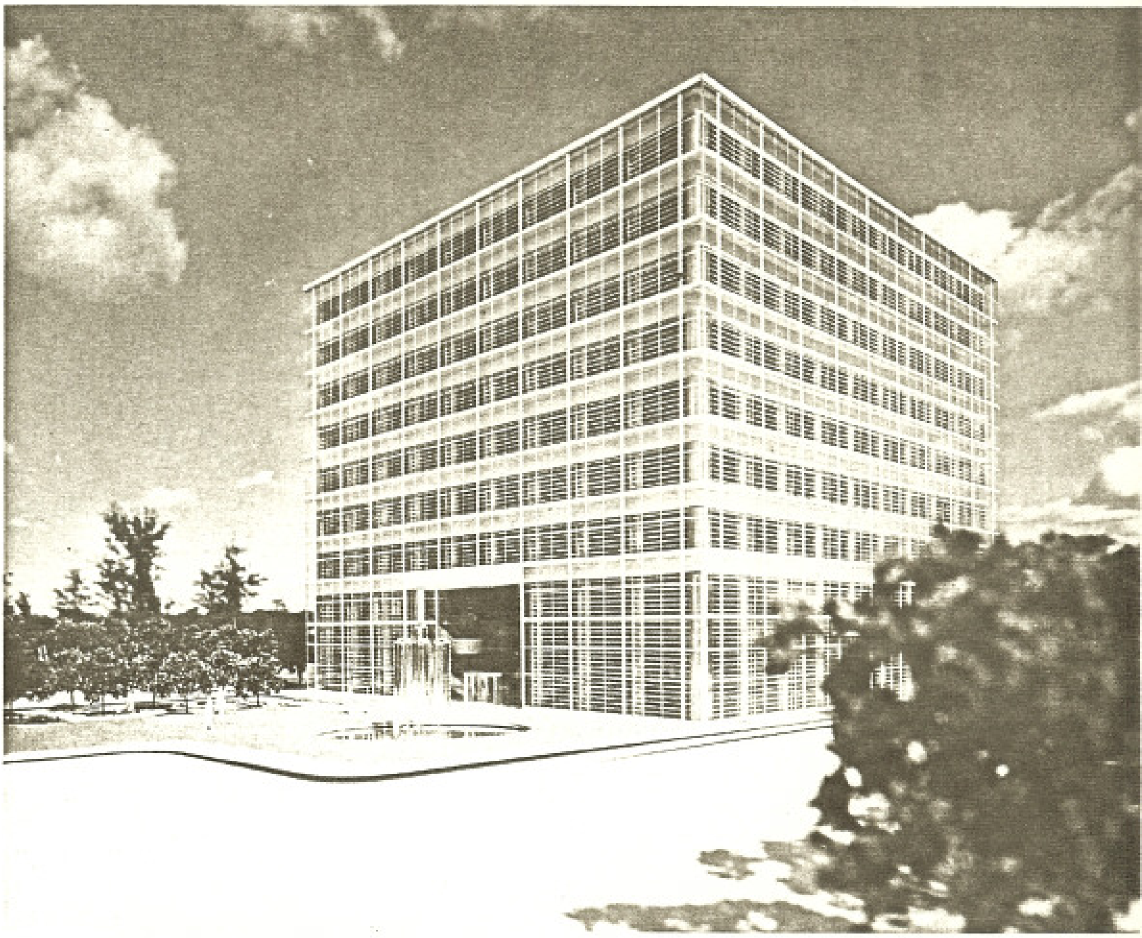
Hooker Office Building,
Niagara Falls, NY

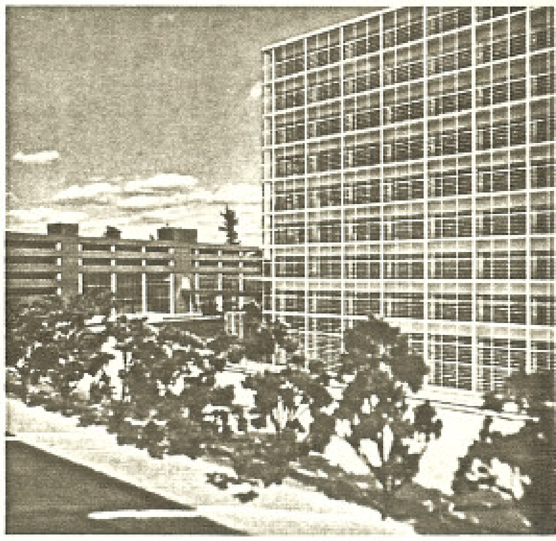
Rainbow's end

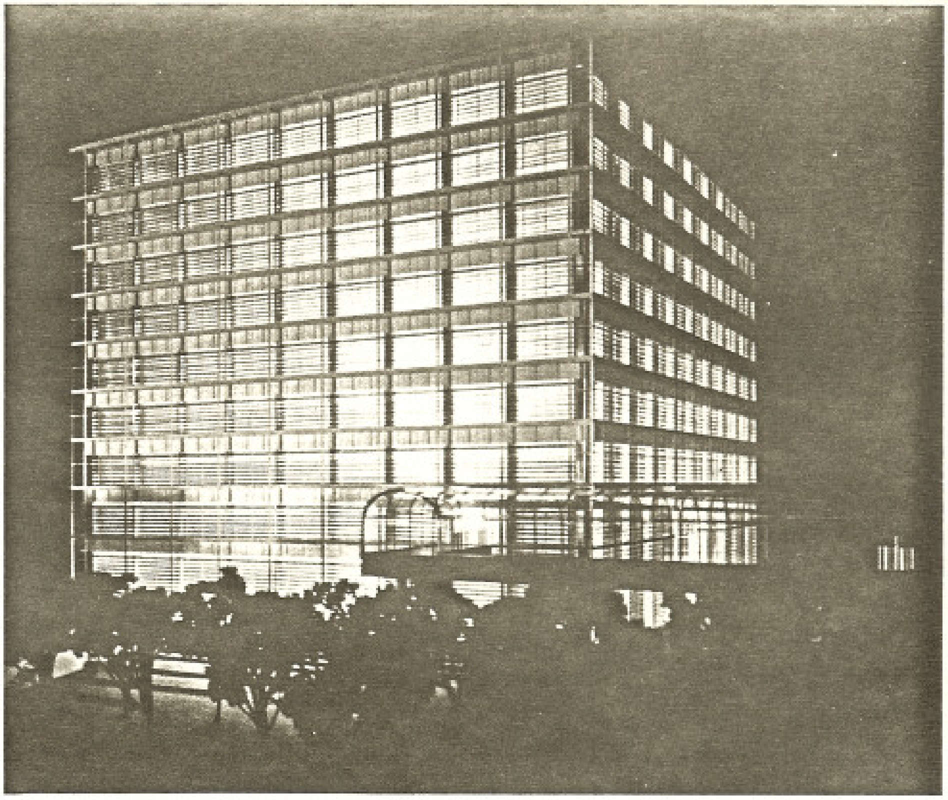
At the south end of the famed Rainbow Bridge on the Niagara River, a new focal point is to greet travelers from Canada.



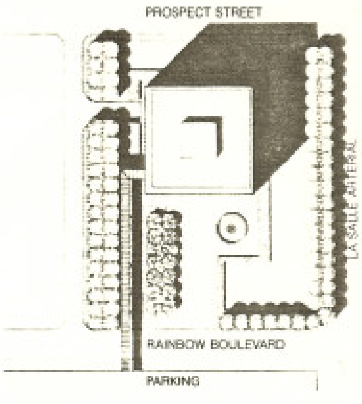
On a very prominent site in a prominent city now fighting to rebuild an almost hopelessly eroded urban core, a new office building will join the effort. The corporate office structure for Hooker Chemicals & Plastics Corporation, designed by Cannon Design Incorporated, is far more than first glance might indicate. The unpretentious square plan, diagonally right on axis with the Rainbow Bridge, expresses its flexible office space function in a largely conventional way—albeit column-free between outer structure and core.

That first glance might not even indicate that an observer is confronted with anything much more ambitious than an admittedly handsome orthogonal, subdivided cube. But the second looks which should be triggered by the building's élan will reveal a whole other layer—literally—of content. The building has two skins, and sophisticated controlling features.





Although the louvers would normally close off façades at night to retain air that is conditioned by day, night model photo (above) gives a vivid indication of double-glazed skin. The northwest corner of the plan (below) points directly to Rainbow Bridge; view south and west frames Niagara Falls.



SITE PLAN

Along with the client's desire to consolidate disparate company facilities, and the intended expression of commitment to Downtown Niagara Falls, both client and architect wanted to do everything possible to promote energy efficiency. Mark Mendell, Cannon's principal-in-charge, describes the initial intent as one of incorporating simple solutions representing current abilities to conserve energy. If possible, off-the-shelf hardware, as opposed to highly technical devices, was sought—with the exception of the control and monitoring equipment, discussed later.

It bothered Mendell and his team that the pat answer to conservation was often to cut glazing areas out, or at least down. In order to both supplement artificial light with natural (reducing power demand) and allow maximum vision areas for the occupants, an extraordinary exterior membrane was needed. Since standard glazing, even double glazing, did not meet the design needs, the architects came up with an inner skin and an outer one, four feet apart. This arrangement, which admittedly will come at something of a cost premium, virtually eliminates air infiltration through the inner layer.

Of HVAC lineage

Between the membranes is possibly the biggest-scale set of venetian blinds ever, and off-the-shelf, no less. Casting about for an efficient yet inexpensive method of installing operable louvers, the designers discovered the system chosen, an assembly of airfoil-shaped louvers long used for HVAC applications. These assemblies will cover all glazed areas of the building envelope except the recessed lobby entry. Motorized screw-shaft rods will provide the power drive for each segment, activated by sensors for each building face.

All façades thus will be controlled separately, and sensors on the louver blades will, when shaded, stop movement. The system will allow horizontal fin alignment for elevations in shade, down to 45 degrees in full sun, or in between. At night when the building is unoccupied, the louvers will close up completely, retaining conditioned air from daytime operation. Even when the louvers are in the full sun position, daylighting properties will be retained, because the light will be refracted into the space by white or near-white fin surfaces.

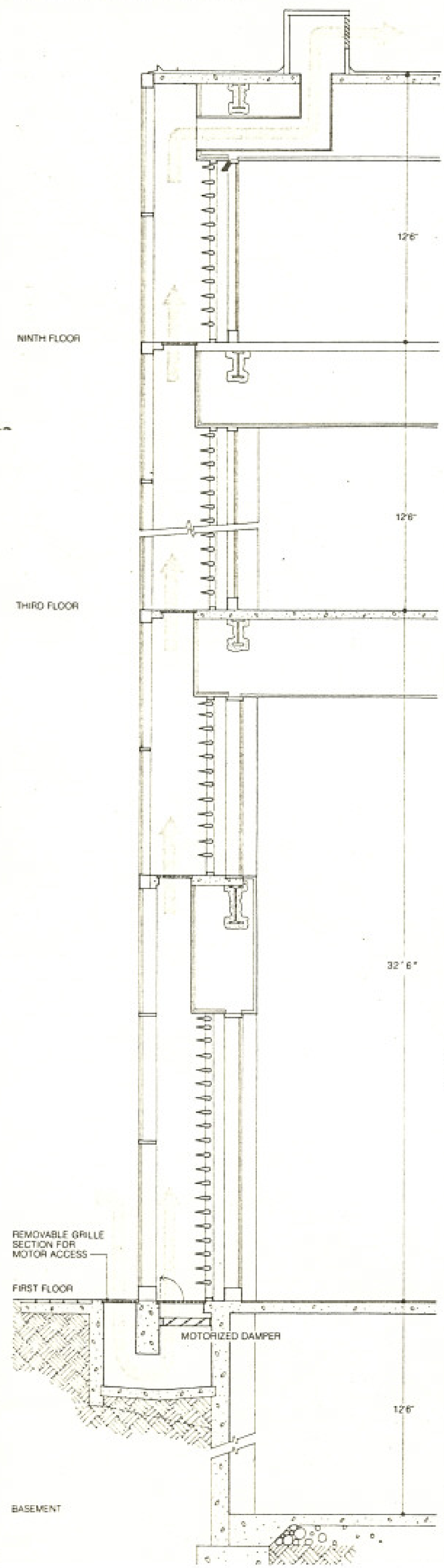
As is obvious, the 4-ft space between building skins is the source of heat build-up in sunny orientations. That's fine, if heat is needed. When it's not, another set of sensors, this time temperature-activated, will operate venting dampers at the top and bottom of the "cavity," releasing the convective warm air at the top. Some convection will also occur *around* the building, with warm air flowing from sunny sides to cooler, shaded exposures. The precise flow of this air is more difficult to predict, but the effect should be beneficial.

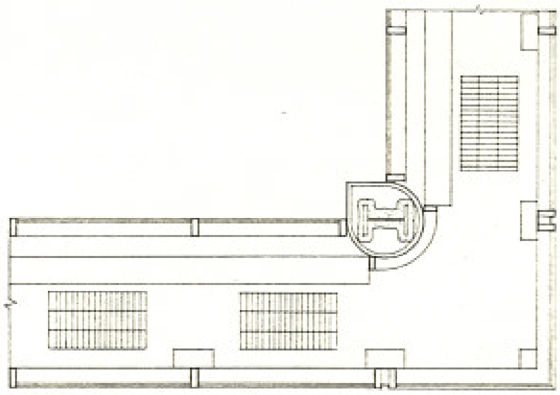
More than skin deep

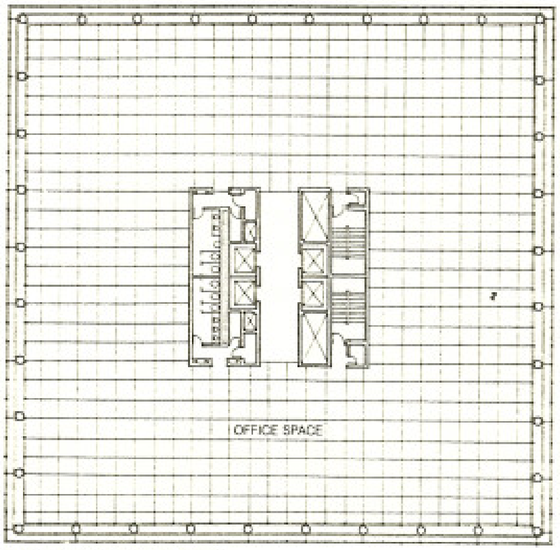
Immediately inside the skin is a 15-ft perimeter lighting zone with two-stage lighting controls to allow for maximum daylighting benefits to reduce power use. The controls will allow for dimming artificial lights in accordance with light levels from outside. Elsewhere on each floor, localized task/ambient lighting will be employed. The designers expect to keep lighting energy use down under 1W/sq ft, taking daylighting into account.

In addition, a comprehensive central computer control center will oversee most building functions. Some of its duties will be to monitor security points, fire safety information, and HVAC dampers, fans, and the variable air volume system. It will also provide for data reduction, allowing precise pinpointing of operating conditions.

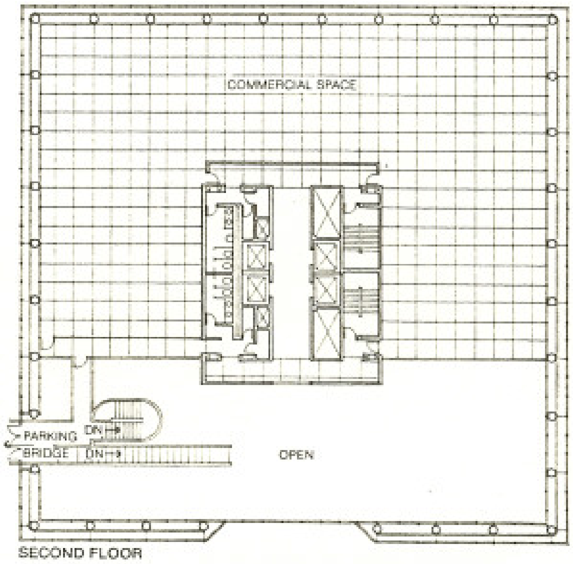
Scheduled for completion in 1981, the Hooker building should be interesting to observe "in action." Mendell points out that, from Rainbow Bridge for instance, the building will change from transparent on the left half to largely opaque on the right at certain times. The sides will vary constantly, depending on weather, time of year, and time of day. It may not be a pot of gold, but the Rainbow should end well, anyway. [Jim Murphy]



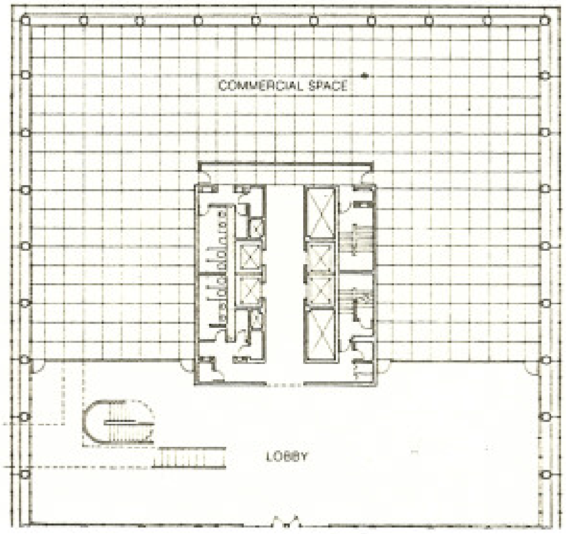

PART PLAN



THIRD THRU NINTH FLOORS



SECOND FLOOR



Data

Project: *Hooker Office Building, Niagara Falls, NY.*
Architect: *Cannon Design Inc.; principle-in-charge, Mark R. Mendell; design team, Mark R. Mendell, Gautam Shah, Charles Arraiz, Alan Sloan, Jack Foster, Gerald Maslona, Dale Gaff.*
Client: *Hooker Chemicals & Plastics Corporation.*
Site: *2.3 acres of open urban renewal land, on axis with Rainbow Bridge linking U.S. and Canada, overlooking Niagara River gorge.*
Program: *corporate office space of 180,000 sq ft and 20,000 sq ft of commercial and office rental space.*
Structural system: *steel frame, metal deck.*
Mechanical system: *electrically driven centrifugal chillers (from which heat is recovered all year), gas-fired boiler, low-pressure variable air volume distribution; all building systems (solar shielding, HVAC, fire alarm, security, etc.) are integrated through a computerized automation system.*
Consultants: *structural, Gillum Colaco; energy, Professor John Yellott, Professor Richard Levine, Burt, Hill, Kosar, Rittelman Associates; acoustics, Bolt, Beranek & Newman; early planning, Hellmuth, Obata & Kassabaum.*
Building Energy Performance/Design Energy Budget: *114,000 Btu/sq ft/yr.*
Photography: *Barbara Martin.*

Energy analysis

This analysis was prepared in the Center for Planning and Development Research, College of Environmental Design, Univ. of California, Berkeley; Vladimir Bazjanac, Ph.D., Project Director. The work is funded by the U.S. Department of Energy.

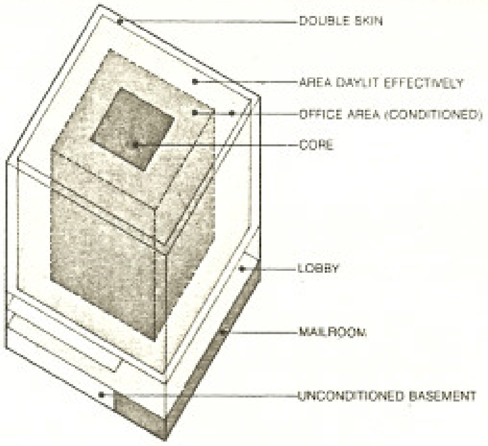
Architectural energy analysis of the Hooker Chemical building in Niagara Falls represents an evaluation of the effect of specific architectural design decisions on the energy performance of the building. This report is a summary of the analysis of building heating and cooling loads which are determined by architectural design. The performance of mechanical systems and energy demanded by them are not included in the results. Electrical loads reported reflect only the demand generated by lighting fixtures and occupant-operated equipment (see p. 104).

The analysis was prepared using DOE-2 program and TRY weather tape for Buffalo, NY. DOE-2 was modified to permit the simulation of venting of the double skin.

The double skin is the most prominent "energy feature" of this building. It performs as an unconditioned thermal zone which changes energy performance characteristics of the building from heating-load dominated to cooling-load dominated. It virtually eliminates infiltration for conditioned zones and reduces the impact of extreme outside temperatures.

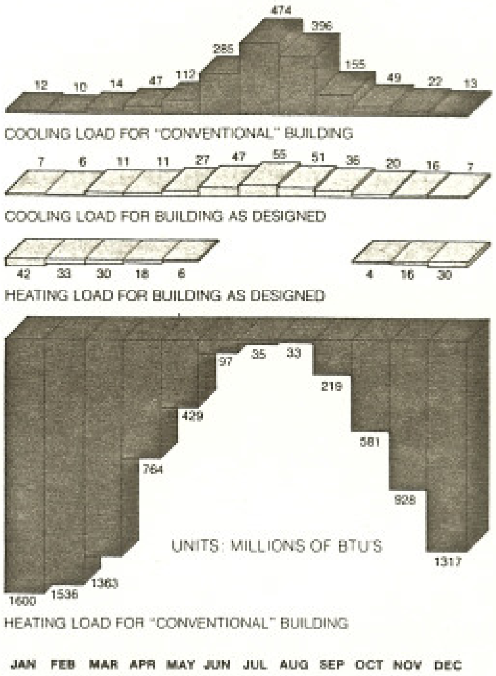
Three basic design alternatives are investigated here: 1) building as designed, 2) as designed, but without venting of double skin, and 3) with conventional double-glazed skin in place of double skin. Different glazing types, shading efficiencies of louvers, and thermostat settings were studied as well. One hundred percent efficient shading assumes that all windows are fully shaded all year. Louvers will not reduce daylighting in the 15-ft-deep zone even when windows are fully shaded (louvers at 45 degrees). The research concludes that combined heating and cooling loads are found to be smallest in the building as designed, but with reversed glazing: single pane on the outside and double pane on the inside of double skin. However, if daylighting works as planned, clear glazing would yield the lowest *combined* heating, cooling, and electrical loads, because of the premium put on electrical costs. [Richard Rush]

Data on the performances of vented and unvented double skin were obtained from tests with a full-scale mock-up by John Yellott, Arizona State University.

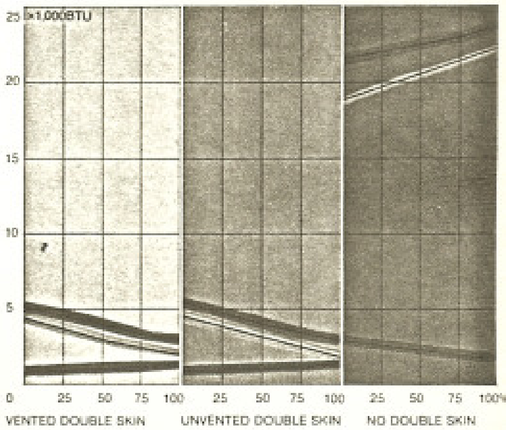


THERMAL ZONING: HOOKER CHEMICAL BUILDING

AERIAL VIEW

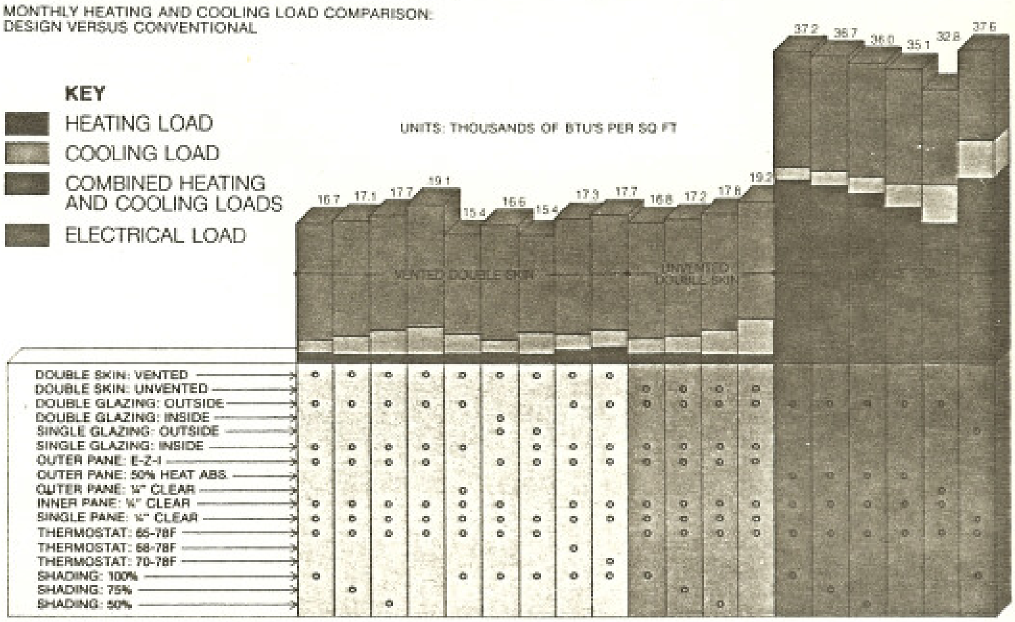


MONTHLY HEATING AND COOLING LOAD COMPARISON: DESIGN VERSUS CONVENTIONAL

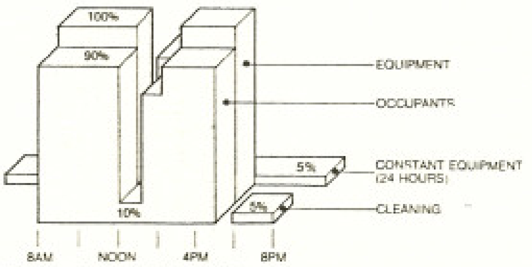


COMPARISON OF PERFORMANCE BY PERCENTAGE OF SHADED GLAZING FOR THE WHOLE BUILDING

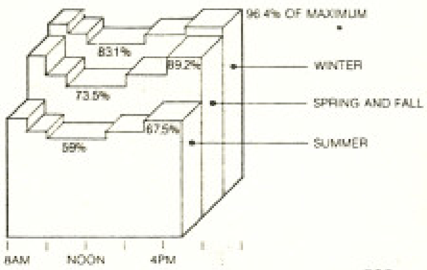
Shading reduces the cooling load and increases the heating load. It is beneficial when the building is dominated by cooling load and counterproductive when it is dominated by the heating load.



COMPARATIVE ANALYSIS OF DESIGN OPTIONS



TYPICAL SCHEDULES OF OCCUPANCY AND USER-OPERATED



TYPICAL SCHEDULE OF ARTIFICIAL LIGHTING FOR