Hooker Office Building,
Niagara Falls, N.Y.

Glass under glass

In a building of Miesian inspiration, the notorious all-glass curtain wall is transformed into an energy-saving double envelope.

Prominently sited in the urban renewal landscape of Downtown Niagara Falls, the Hooker building has the freestanding Euclidean form and the sleek, ordered surfaces associated with the heyday of Modernism—and with the flood tide of energy consumption. In fact, Hooker is a remarkable adaptation of the Miesian curtain-walled form as a model of energy conservation.

When Cannon Design got this commission, back in 1978, it was clear that Hooker wanted a symbol of its commitment to reviving the core of Niagara Falls. The site was not only highly visible, but offered views of the Niagara River in three directions, so the architects sought an alternative to the constricted window areas then prescribed as a reaction to energy shortages. Assured of unobstructed solar access, they recognized that daylighted interiors offered opportunities for major energy savings, if only heat loss through the glass could be kept low. Pooling their own architecture and engineering skills with the talents of consulting firms (see Data), Cannon came up with a double-envelope scheme.

The key to the design is the 4-foot-wide void between an outer wall of green-tinted insulating glass and an inner wall of clear single glazing. Heat that builds up in this gap under sunny conditions can be vented at the roof. Louvers within the void are adjustable to keep out direct rays; they can be closed entirely at night to keep heat in. Daylight, dispersed by the louvers, provides ample illumination of the outer 15 feet of the office floors—44 percent of their usable area.

P/A's Energy Analysis of the building as designed (April 1980, p. 105) showed Hooker's heating load to be only about 2 percent of that for a "conventional" building of the same volume, and its cooling loads only about 19 percent. These remarkable savings were attributed in part to the virtual elimination of infiltration—a great advantage in this exposed location.

Although calculations were confirmed in full-scale mock-ups, Cannon principal-in-charge Mark Mendell recalls that the double-envelope design demanded courage on the clients' part: "It worked on paper, but there was no real model to show them—and

these were people who would not have bought a car in its first model year."

One of the operating advantages that could not be adequately predicted was the movement of air around the building between the envelope layers. The designers got what they hoped for: Under the most extreme conditions (sunny, very cold, windy), temperature in the buffer space varies 10 F from bottom to top; convection currents reach around the corners, holding the temperature differential between north and south sides to 15 F, at most (i.e., the average temperature between envelopes might be 68 F on the south, 53 F on the north).

Energy performance of the building has been affected significantly by changes in use since the building was programmed (changes that also underscored the adaptability of the square, column-free floor layouts). The location here of a major computer installation, working around the clock, has doubled the building's demand for power (which is plentiful in Niagara Falls). The spread of the office day beyond the anticipated eight hours has increased the use of artificial lighting. The additional heat generated has eliminated the heating demand altogether; the gas-fired boiler has literally never been used for heat. And the louvers are never closed except during rare weekends when the computers are shut down *and* the weather is very cold.

Clean machine

In detailing this energy tour de force, Cannon Design chose a vocabulary of simple cross sections and hidden connections. Even given its minimal form and regular structure, the building could have had more Constructivist detailing, emphasizing structural sections and connections, perhaps with colors—an ap-

garden by Cesar Pelli (P/A, Aug. 1978, pp. 72–79). This would have underscored, rather than understated, the building's unconventional concept.

As it is, only the louvers introduce some unaccustomed hardware. These off-the-shelf components, intended to control air in large ducts, span the 15 feet between columns and provide full shade at a vertical spacing of 8 inches, enough of a gap to afford an unobstructed view from close up; their airfoil sections have no aerodynamic use here, but turn out to be excellent for dispersing light. The louver system seems to present little distraction to workers inside, after the first couple of weeks.

The green glass, which transmits 80 percent of visible light, has no noticeable effect on views or indoor colors. From outside, the greenish glass and the white grids on and behind it emphasize the transparency of the envelope: gray or bronze tones would have contrasted with the sky and looked more opaque.

Every aspect of the exterior underlines its regularity and unity. The glazed bridge that connects it to a parking garage is clear and tubular and held away from the main cube to preserve its integrity. The main ground-floor entry (which gets less traffic) has been subtly but effectively marked by carving away the tinted and louvered layers to expose a rectangle of clear glazing.

Cannon has put its energy experience to work on other buildings: their Norstar Building in Downtown Buffalo, with a less adventurous daylighting concept, has won an OCF Award (P/A, Jan. 1983, p. 21). Asked whether Cannon has considered the double envelope for subsequent projects, Cannon engineer Alan Sloan answers that it is "always under consideration, but it's not a panacea." For double-envelope to work, he explains, you need special circumstances—all present here: an open site, a commercial function, and infiltration as a major factor. Asked about the "payback" period for the double envelope, Sloan objects that the *concept* of payback fails to recognize offsetting savings such as, in this case, cutting the mechanical systems contract about in half. The building came in for less than the client's original budget, he says. "We paid no premium for the double envelope, so no payback is due."

For now, Hooker remains the landmark application of the double-envelope concept —and serene proof that high energy performance need not call for unconventional forms. [John Morris Dixon]

Inside double envelope, louvers eight inches apart control sun; airfoil shapes temper light-dark contrast and diffuse light into offices. Corner office (below) may have louvers at different angles—from horizontal to 45 degrees down, on different exposures. In lobby (bottom), louvers and outer glazing are cut away to leave clear glass around entrance.

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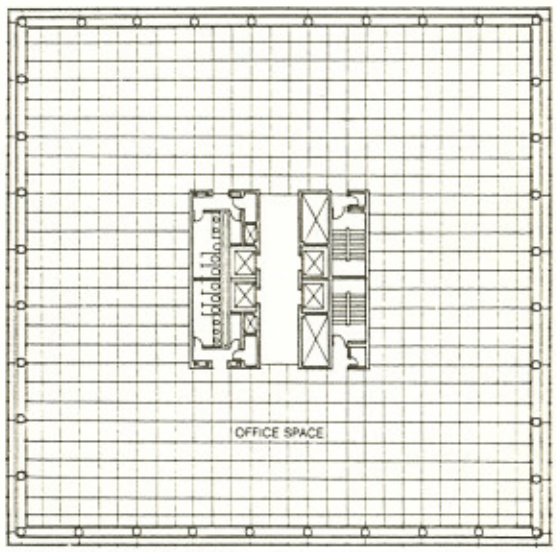

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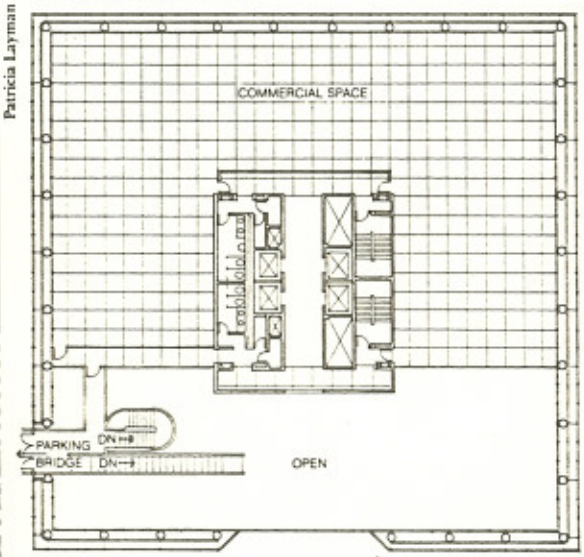
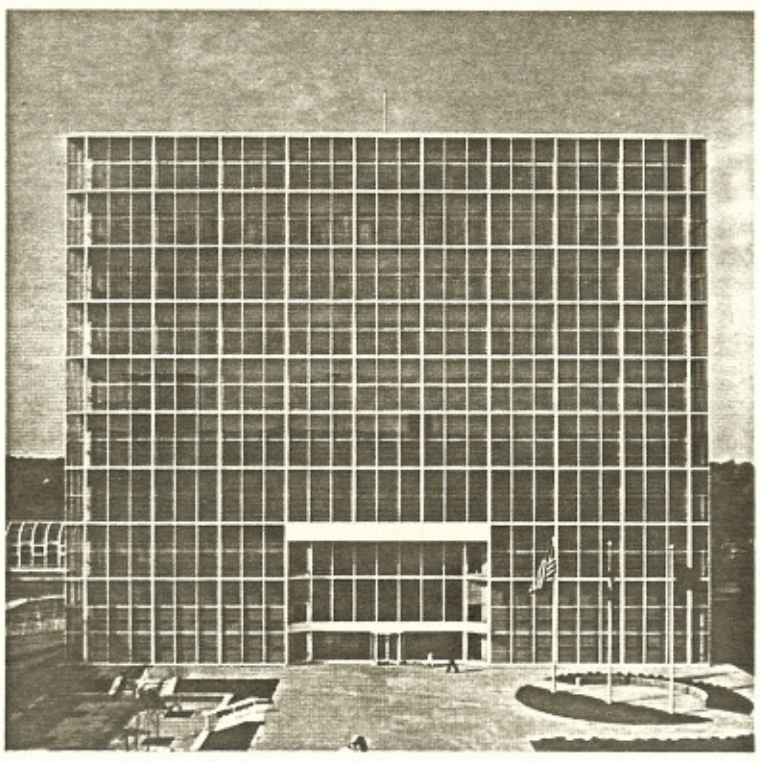


SECOND FLOOR

Sited on axis of the Rainbow Bridge from Canada, the building stands amidst tourist parking lots (aerial photo, opposite) with views of Niagara River and Gorge to south, west, and north. An enclosed footbridge leads to a parking garage with indoor links to shops, Wintergarden, and hotel. Entrance front (this page) faces east, toward other buildings. Night view reveals louvers and inner glazed wall, only partly visible by day through outer layer of green glass.



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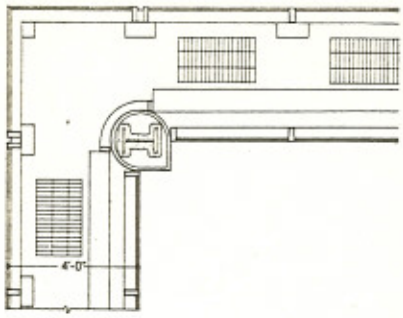
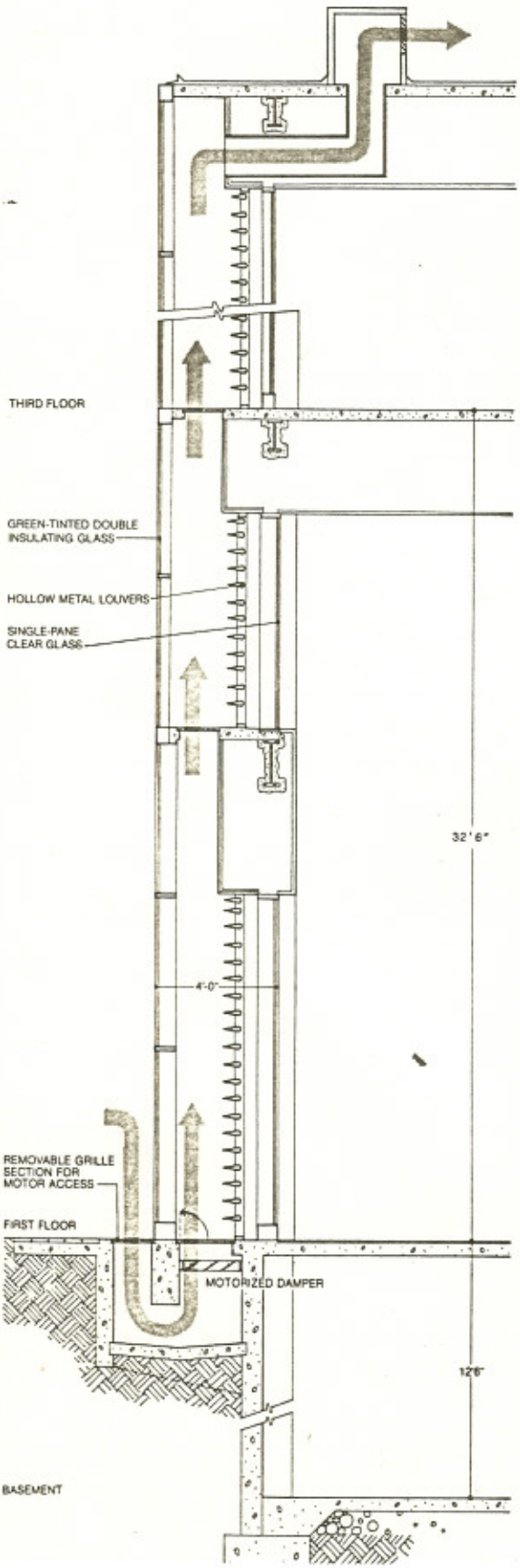
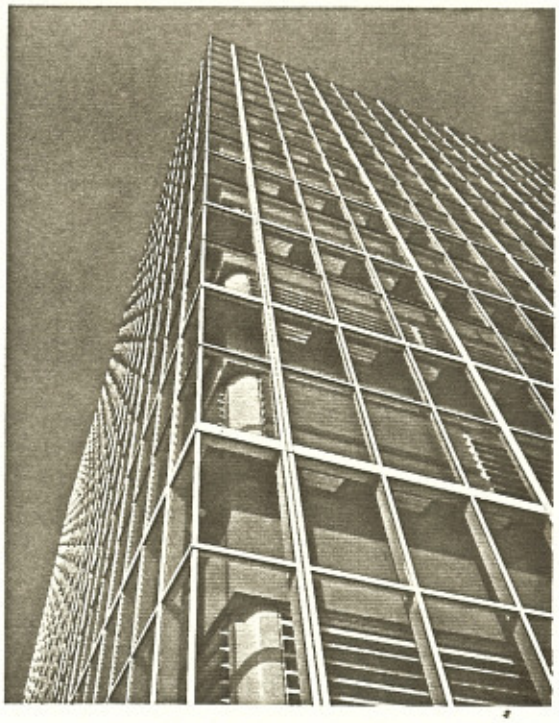


PLAN AT CORNER





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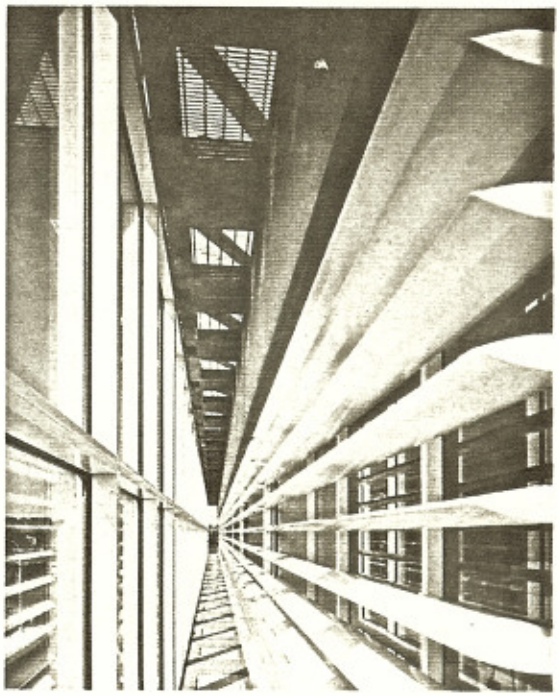

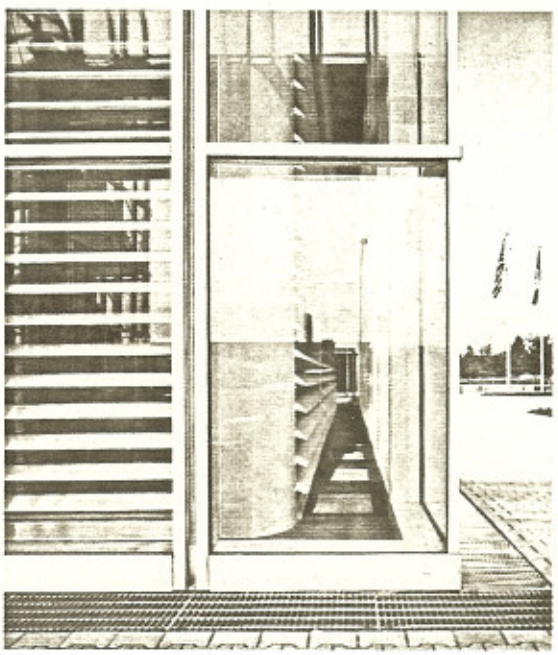

Detailing of double envelope involved many subtleties: white aircraft paint on louvers yields best light diffusion and least heat gain; beige carpet in "raceways" (center photo) looks clean and reassuring from inside; light sensors to control tilt of louvers are carefully placed in pairs to discount mullion shadows; delayed response cancels effect of passing clouds.

Data

Project: *Hooker Chemical Corporate Office Building, Niagara Falls, N.Y.*

Architects: *Cannon Design, Inc., Grand Island, N.Y.; Mark R. Mendell, principal in charge; Mark R. Mendell, Gautam Shah, Charles Arraiz, Alan Sloan, Jack Foster, Gerald Maslona, Dale Gaff, Douglas Purcell, design team.*

Site: *2.3 acres of open urban renewal land, on axis of bridge linking U.S. and Canada, overlooking Niagara River gorge.*

Program: *corporate offices of 161,150 sq ft plus 41,300 sq ft of commercial and office rental.*

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 systems (solar shielding, HVAC, fire alarm, security, etc.) integrated through computerized automation system.*

Major materials: *double-envelope tinted and clear glass curtain walls; aluminum louvers; coffered ceiling-lighting systems (see Building materials, p. 176).*

Consultants: *Gillum Colaco, structural; Prof. John Yellott, Prof. Richard Levine, Burt Hill Kosar Rittelman Associates, energy; Bolt, Beranek & Newman, acoustics; William Prentice, Architects, interiors.*

Consulting architects: *Hellmuth, Obata & Kassabaum.*

General contractor: *Siegfried-Scrufari Joint Venture.*

Costs: *$12,500,000 (bid, Jan. 1980), about $62 per sq ft.*

Photos: *Barbara Elliott Martin, except as noted.*