The Occidental Chemical Center

Niagara Falls, New York, 1980, Cannon Design Inc.

The Occidental Chemical Center (or Hooker Building) in Niagara Falls, New York was the first building in North America to be constructed with a Double-Skin Façade. Built on the heels of the 1970s Oil crisis, the client, Hooker Chemicals & Plastics Corporation, wanted both an energy conscious, yet distinguished flagship building that exploited the prominent location on the edge of the Niagara Gorge for its views, and also revitalized the faltering downtown core by its siting on axis with the Rainbow Bridge between Canada and the United States. The Hooker Building is touted as being "one of the most energy efficient commercial buildings in the world" and is the recipient of numerous citations for design excellence from the AIA and Illuminating Engineering Society as well as the Energy Conservation Award from the Owens Corning Fiberglas Corporation and the EPA Energy Star *(EPA, 2001)*. Completed in 1980, it becomes one of the oldest examples of the "modern" Double-Skin building, and provides twenty-one years of valuable performance information on this controversial building technology.

The Hooker Building West facade from Niagara Gorge parking lot and detail of the Southeast corner with pedestrian bridge that formerly connected to the parkade.

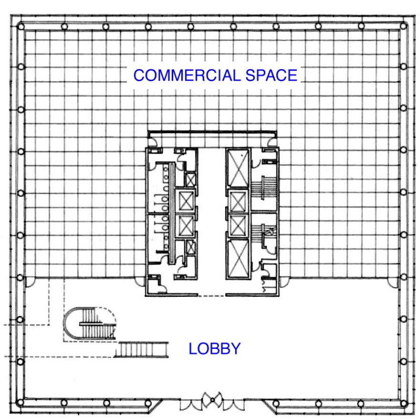
Design Intentions:

In order to best exploit the views of the Gorge offered by the North, West and South sides of the building, Cannon Design Inc. elected for floor to ceiling glazing on this otherwise conventional nine-storey cube with central service core surrounded by office and retail space. In order to meet the other design criteria of the client, the architects decided to explore the use of a Buffer Façade with an undivided air space continuous over the entire building with motorized dampers for air intake at grade and vents at the top.

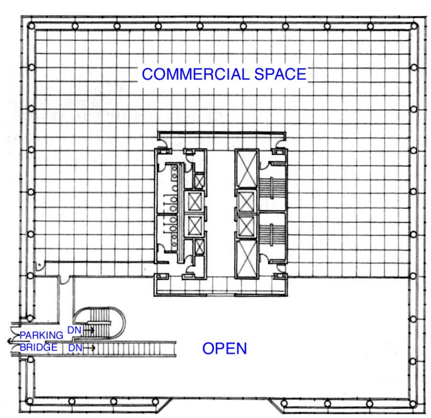
The building is comprised of two different air-handling systems: one for the façade and the second for the conditioning of the interior spaces. Due to the energy conscious mindset at the time, this system was selected because it does not allow for the occupants to have direct access or control over natural ventilation (hence less variable incoming cold air to heat, the less energy spent heating it), but instead it is controlled as part of the air intake of the ambient HVAC system. This design also allows the warm air within the wall cavity to temper the outside air on the exterior skin and act as a “buffer” for the interior layer of glass.

The building envelope is comprised of two layers of green-tinted insulating glass that allow for 80% solar penetration as the exterior skin, a 1200mm air space containing hollow metal, air-foil shaped, white louvers - spanning fifteen feet and vertically spaced eight inches a part - with service grilles (originally covered with beige carpeting to give the appearance that the floor continued from within the offices through to the exterior glass), and one layer of clear glass as the interior skin. As a means of being economical, the architects made sure that all the components of the façade -

Above: the current North Facade. Below: floor plans showing the original entrance cut into the East facade; the only place in the building where the otherwise uniform facade is interrupted.



FIRST FLOOR



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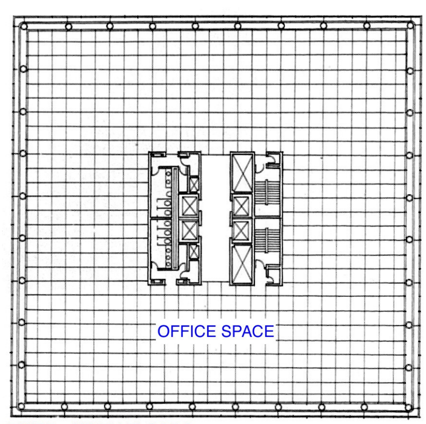
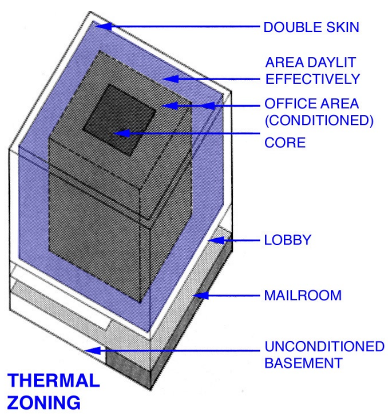


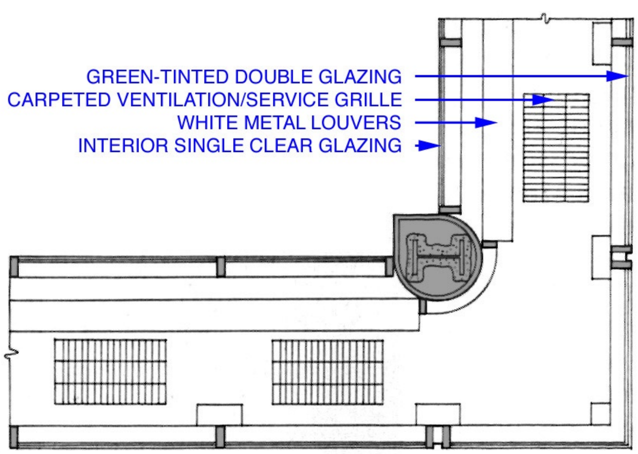
THIRD - NINTH FLOORS

save the control and monitoring equipment - were “off the shelf.” The louvers in the air cavity are controlled by an “intelligent” light sensor system that responds according to weather, time of day and season. The sensors are placed in pairs to discount mullion shadows and a delay response cancels the effect of passing clouds. The façade is separated into four different “zones” according to the North, South, East and West exposures so that each of the four walls may respond according to the amount of daylight being admitted according to the particular time of day. The louvers are capable of fully closing as means of providing additional “insulation” during the winter months.

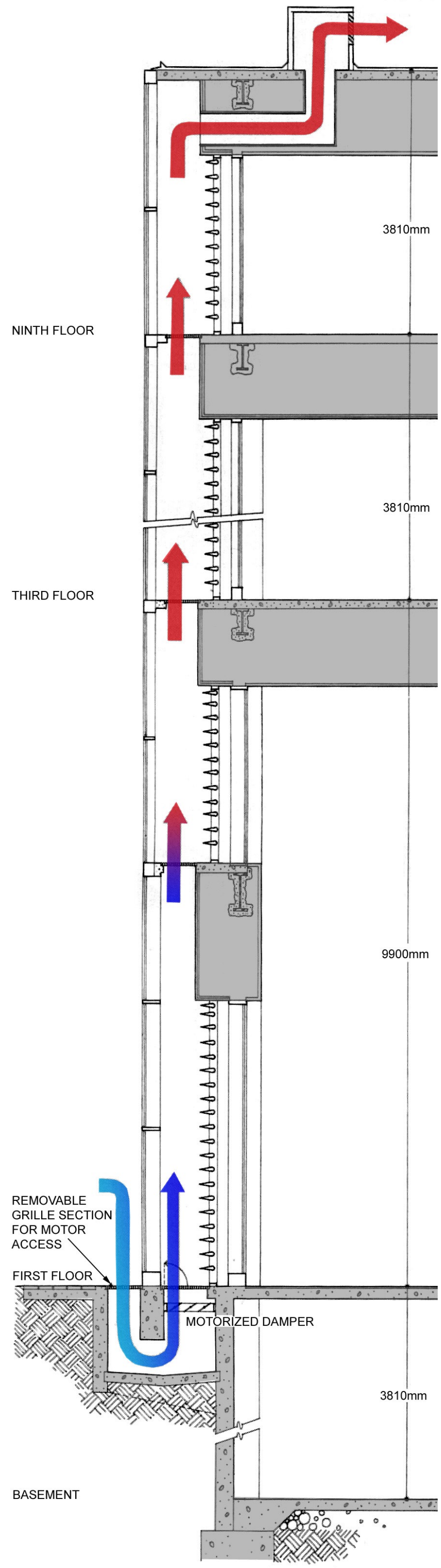
Initial Problems:

The occupational needs of the building changed as construction neared completion. Instead of the anticipated cooling load for day time office workers, the building was now to be occupied by research facilities with hours that extended into the evening as well. According to the architects, the original design of the wall system cut the mechanical systems requirements in half, thereby offsetting the cost of the second skin. However, with the changes in occupational require-





The Hooker Building Southern facade is pictured here along with the thermal zoning design schematic showing both areas with daylighting and the differing HVAC zones, along with both vertical and horizontal sections through the buffer facade.



ments, the cooling loads increased significantly and the gas-fired boilers that were installed were never required to heat the building, not even during extreme winter weather.

Originally the louvers were to be painted with a highly reflective coating to minimize solar heat gain and allow for sunlight to be refracted deeper into the space. However, the glare created from the coating was blinding motorists as they crossed the bridge, so the louvers had to be repainted with a matte white finish.

Current Problems:

The Hooker Building is currently undergoing a major renovation. Bought by AquaFalls Inc., the plaza at the original East Entrance of the building is being developed into a 40,000 square foot aquarium that will incorporate tunnels with shops and restaurants beneath the surface and turn the original building into the North American headquarters for the company. Despite the US$35 million promised investment, due to delays the building is currently occupied on only three out of nine floors. Complications have also arisen due to the excavation in front of the building: the intake grilles at grade have been covered with plywood because of the amount of dust, dirt and particulates that were accumulating in the wall cavity, and therefore air is unable to be drawn through the façade causing chronic problems with over-heating in upper floors. Because of the low occupancy, the design cooling load is not being met and consequently lower floors are recurrently too cold.

According to the security personnel the louvers ceased to function four years ago, and haven't been serviced since. Because of this they are stuck in a horizontal position and only negate 50% of the incoming solar radiation on the South side of the building and even less on the East and West façades. Tenants have since taken the initiative and installed vertical blinds on the inside of the office space in an attempt to have some solar control. Because of the current disrepair and neglect of the building in its interim state, the current tenants of the building constantly complain of being either too hot or too cold. There

The original East entrance now overlooks the excavation for the aquarium, as a corner detail reveals a glimpse into the currently inactive wall cavity.

has also been significant clouding formed on the inside of the exterior glass, resulting in a blemished façade.

Considerations:

The Buffer Façade was adopted in order to achieve specific environmental goals: to reduce the cooling load in the summer and lessen heating loads in the winter. However, in their preoccupation with conservation of energy, the designers seemed to overlook the problems that would result from a system wide failure of the façade. Despite the numerous citations and awards the building has received, the controls failed, the building is rendered extremely uncomfortable and energy inefficient. Ironically, after twenty-one years, the only parts of the building façade that are still functioning are those that were "off-the-shelf" and not the custom monitoring and controlling equipment.

The gravity of the problems currently faced by the Hooker Building is directly related to the inadaptability of the façade. If comparing the Buffer Façade to a Twin-Face Façade, the natural ventilation and operable windows integrated into the Twin-Face Façade make the envelope still useful - and solely problematic - in case of complete failure. Because fresh air is still able to circulate through the façade and into the interior spaces, better working conditions and comfort levels are maintained, as opposed to the static, airless position of a failed Buffer system.

The Achilles heel of the Buffer Façade seems to be the exact thing that makes it function: the mechanical dependence for control of ventilation, dampers, fans, windows, and louvers. In a standard curtain wall system, these are never concerns. Is it fair to judge the Buffer Façade in comparison with a high performance curtain wall system that doesn't depend on "intelligent" systems? When the concern of the architect is with using "off-the-shelf" components (like a curtain wall system) the answer seems to be yes. Still the question remains: would the façade have lasted longer had it been properly maintained and repaired, or would these same problems have occurred if the building had not changed owners multiple times and been neglected?

Photos of the interior of the wall cavity and clouding of the exterior skin. Detail photo of skin clouding taken by Terri Meyer-Boake.

Looking to the Future:

The problems incurred by the Hooker Building raise valid concerns regarding the longevity and life-cycle costing of this type of building façade. It remains to be seen how the renovation will affect the building and how, with replacement and repair, the system will perform in another twenty years.

Quick Building Overview

Building:	The Hooker Office Building/Occidental Chemical Center
Client:	Hooker Chemicals & Plastics Corporation
Year:	1980
Architect:	Cannon Design Inc., Principal, Mark R. Mendell
Consultants:	Hellmuth, Obata & Kassabaum
Programme:	16000m2 Corporate office space with 4000m2 leaseable commercial space
Site:	Niagara Falls, New York, Northwest corner diagonally on axis with Rainbow Bridge, overlooking the Niagara Gorge on North, West and South sides
Climate:	Cold
Facade Construction:	Buffer Facade with undivided, full height air space
Cavity Dimension:	1200mm
Daylighting:	Maximizes exposure with floor to ceiling glazing
Shading:	Operable louvers in air space with photocell control and manual override
Adaptability:	Facade divided into four zones one for each orientation and are independent of each other as they respond to time of day and sun angle
User Control:	Only indirect control through the use of vertical blinds
Ventilation:	Two systems: one for the extraction of air from within the wall cavity the second for conditioning of the interior spaces
Aesthetics:	Square plan office tower covered in ubiquitous green glass skin
Structural System:	Steel Frame, metal decking
Mechanical System:	Cooling - Electrically driven centrifugal chillers (for year-round heat recovery) Heating - gas-fired boilers Ventilation - low pressure variable air volume distribution All building systems (louvers, HVAC, fire alarm, security) all controlled by centralized automated mainframe computer
Design Energy Budget:	114,000 BTU per square foot per year
Cost:	US$12,500,000 (Bid January 1980) Approximately US$62 per square foot

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*All text and drawings by **Kate Harrison** with contribuitions made by **Terri Meyer-Boake.** All photos taken by **Kate Harrison** unless otherwise noted.*

*Please note **the bibliography is incomplete** and will be made available as soon as possible.*

Cannon Design Inc:
http://www.cannondesign.com/portfolio/corporateandcommercial/OccidentalChemicalCorporation.cfm

EPA – Energy Star Labeled Building Profiles
http://estar4.energystar.gov/estar/CPDCaseStudy.nsf/OProfiles/occidentalchemical.html