



VIEW TO NORTHEAST



VIEW TO SOUTHEAST



ELEVATED SOUTHEAST VIEW



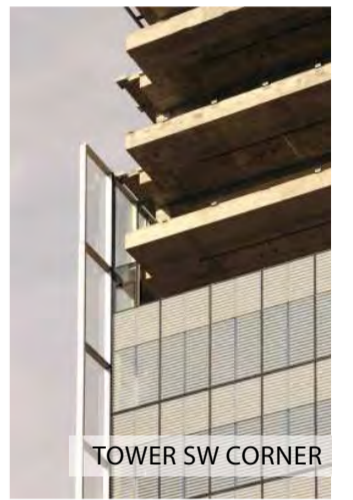
TOWER OFFICE FACING SOUTH



DOUBLE FAÇADE CAVITY

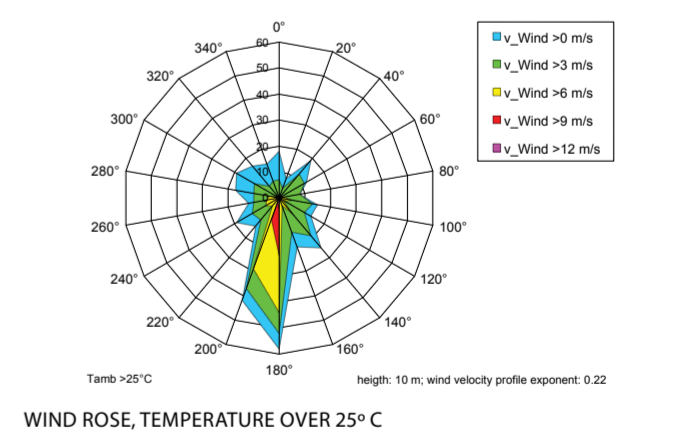
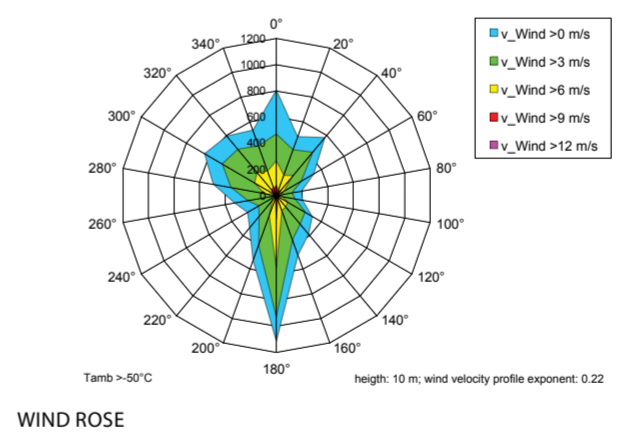
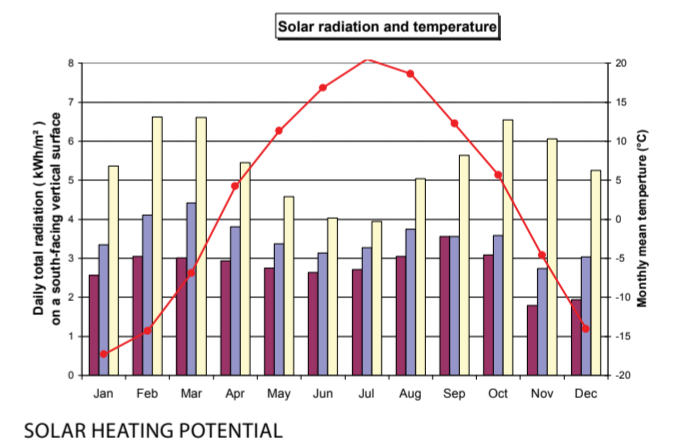
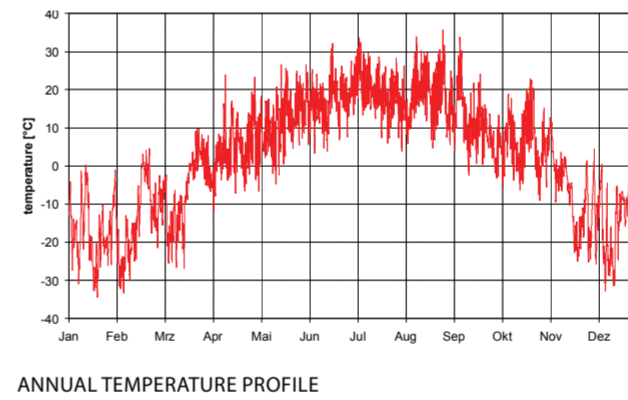
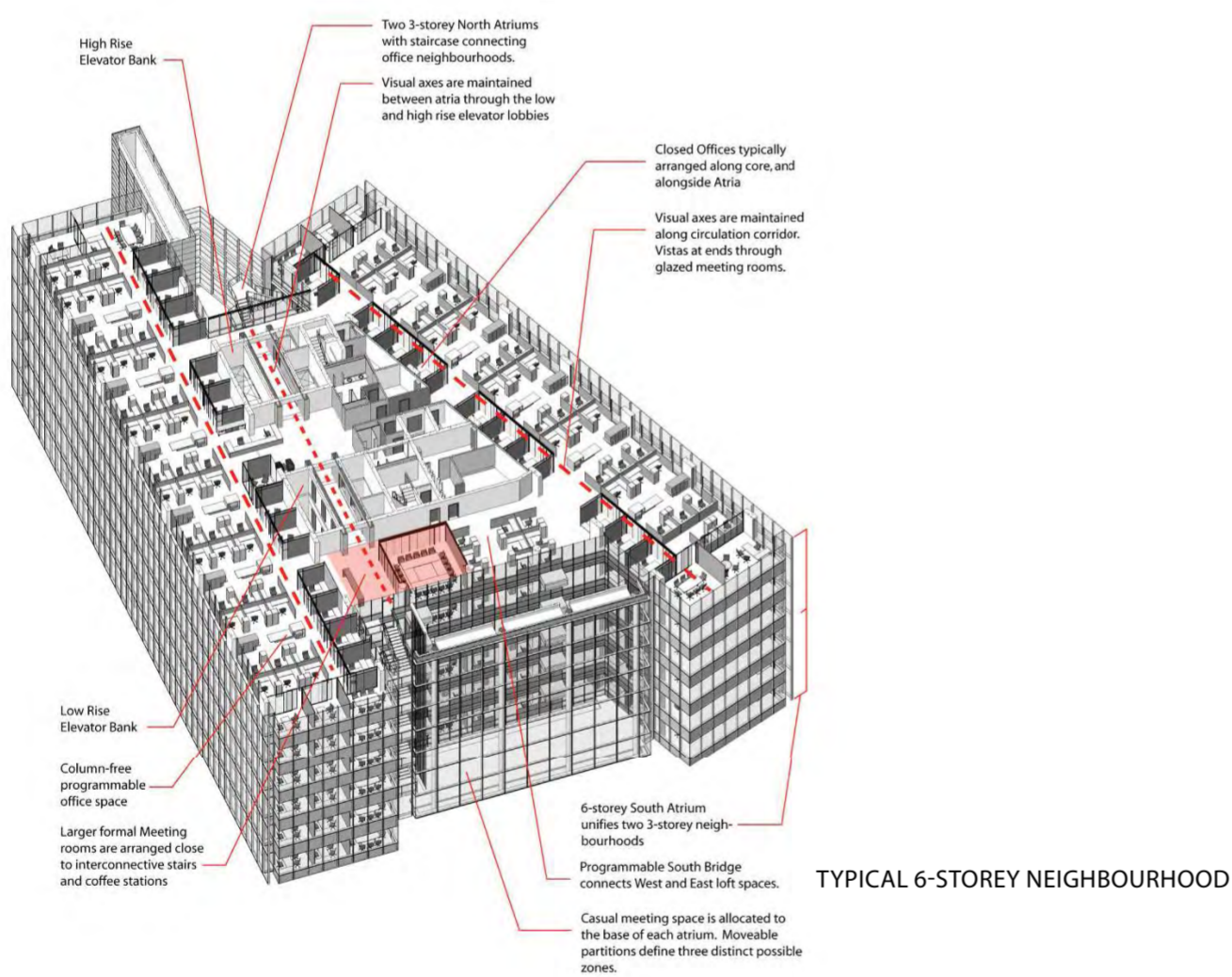


TOWER OFFICE AT DOUBLE FAÇADE



TOWER SW CORNER

IN A CLIMATE OF EXTREMES - MANITOBA HYDRO DOWNTOWN OFFICE PROJECT



A Model for Cold Climate Design

Winnipeg is the coldest city in the world with a population over 500,000. It is also the sunniest location in Canada and boasts the hottest and most humid summers supported by the highest air conditioner use per capita. Temperatures vary 70 degrees over a year, plummeting below -35°C in the winter, and soaring above 35°C in the summer.

The new 64,800 m² headquarters for Manitoba Hydro is located in downtown Winnipeg. As the 4th largest electrical utility in Canada, the design of their new building had to take a quantum leap in energy efficiency and carbon emission reduction. A primary goal was to achieve 60% reduction below national standards for energy consumption.

An Integrated Design Process (IDP) was essential in realizing the daunting project goals which intersect all areas of aesthetics, sustainable design and energy performance:

"Manitoba Hydro's new head office building in downtown Winnipeg will be a functional, state-of-the-art energy efficient (Power Smart), cost-effective structure that embodies and demonstrates Manitoba Hydro's commitment to sustainable development. While meeting the business needs of Manitoba Hydro, the office building will have a positive impact on the future of Winnipeg's downtown and be a source of pride for Manitobans." - Client's Brief, 2003

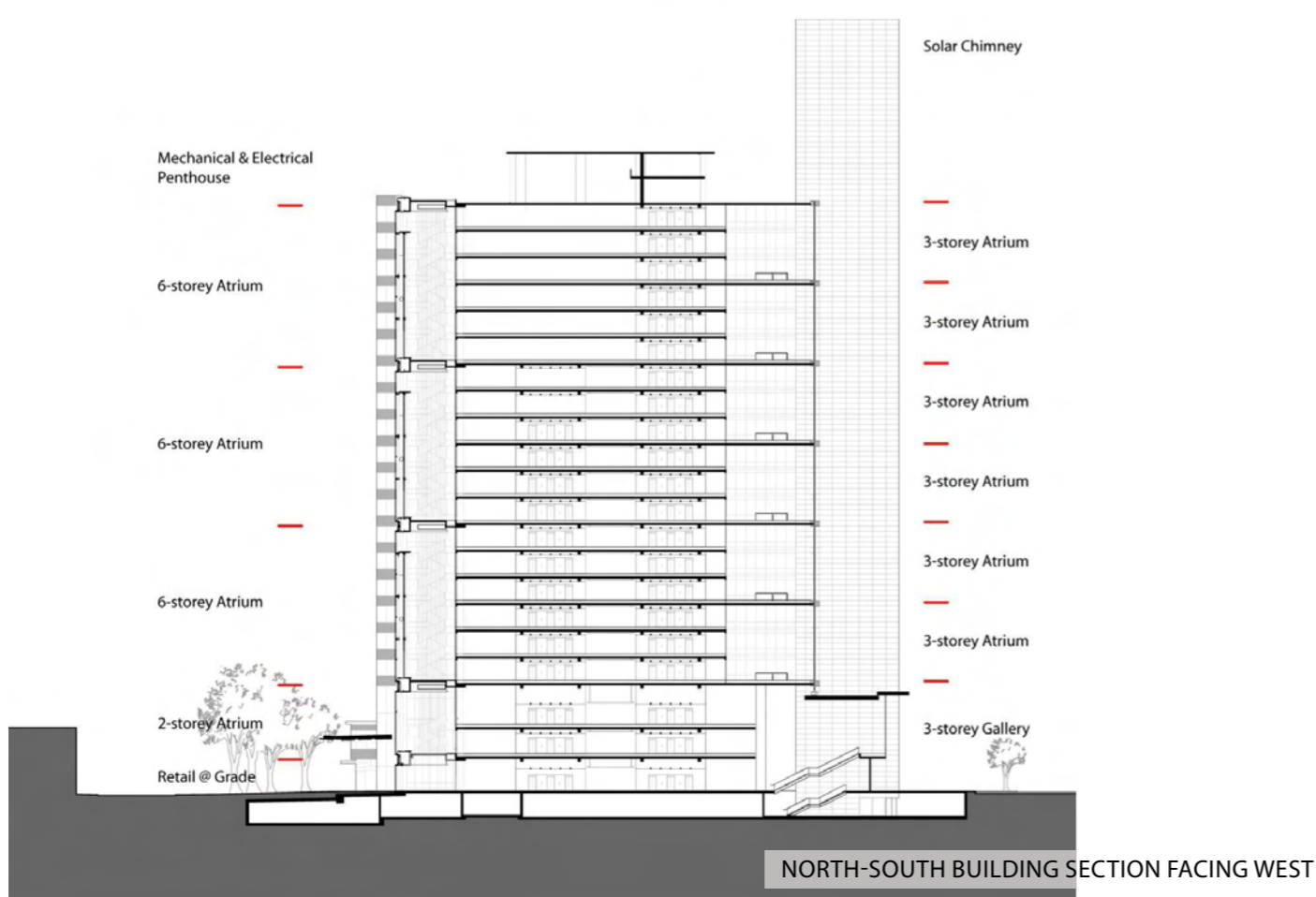
The final concept is the result of a rigorous year long IDP process. To achieve the 60% energy target, passive systems are maximized. To that end, the form and massing are driven by solar and wind energies, and a design that operates in three seasonal modes (winter, summer, shoulder). Two towers converge at the north and splay open to the south to capture the maximum sunlight and strong southerly winds unique to Winnipeg's climate. The space within the splay is

partitioned into stacked atria which act as solar collectors, and combined with a solar chimney, perform as the 'lungs' of the building for maximum fresh air.

The building is effectively triple glazed on all surfaces, with north and south atria acting as double façades. The double walled facade is delaminated into distinct single- and double-glazed walls, with a buffer zone in between. The temperature between the two walls fluctuates naturally for most of the winter months, maintaining the performance of a triple-glazed façade. While buffer zones are configured in the winter for thermal insulation and fresh air heating (in the case of the south atrium), their configuration changes with the seasons.

The south atria also feature a water wall that enriches the space while efficiently adjusting humidity. A 24 metre tall water feature comprises 270 tensioned mylar ribbons with conditioned water running down each ribbon - chilled water dehumidifies the air in summer and warm water humidifies in winter. Per-floor air handling units further temper fresh air as necessary and blow it into a pressurized subfloor plenum on each level from which it enters the office spaces at outlets located along the perimeter.

While the project demonstrates the value of the Integrated Design Process to achieving environmental and ecological objectives, it ultimately prioritizes its value to improving the quality of human experience and to investing in the future health of our cities and communities by creating a healthy, supportive work space with active, engaging public spaces to contribute to Winnipeg's public realm.





DOUBLE GLAZED CONSTRUCTION PHOTO

DOUBLE FAÇADE

The high performance façade was designed to exceed best infiltration/exfiltration practices (MNECB 0.9m³/hm² at 50Pa) but exceeded it in testing mock-ups where the double façade values were measured at 0.013m³/hm² at 50Pa, and 0.02m³/hm² at 150Pa.

Its exterior is a high performance double glazed unitized curtainwall assembly with low iron glass and special low e coatings to permit maximum light transmission (aiding in office daylighting) and minimal solar heat gain shading (preheating the air within the cavity during shoulder seasons).

By maximizing the glass size for the exterior of the unitized Double Wall assembly, heat losses through the frame assembly were minimized. As well the construction is optimized to reduce costs.

4m floor to floor heights, along with a stepped perimeter slab edge at the buildings east and west tower facades, increase daylighting for interior office spaces.

Automated louvre shades located within the double façade control solar heat gain and glare within the office space. By locating it within the double façade heat gains, particularly in summer, are kept out of the office space. A daylighting portion at the top of the shade, directs light further into the office space.

Motorized operable windows at the outer wall of the double façade permit natural ventilation at seasonally appropriate times of the year. Vertically stacked operable vents at each gridline allow a continuous flow of air in and out of double façade cavity along the length of each tower floor.

Manually operated hopper style vents at the interior glazing line allow building users to access natural ventilation in the double façade cavity, during the shoulder seasons.

Motorized operable vents at south and north ends of double façade, in conjunction with curtain-wall wings, use site specific predominant south winds of Winnipeg to moderate the air passage throughout the cavity.

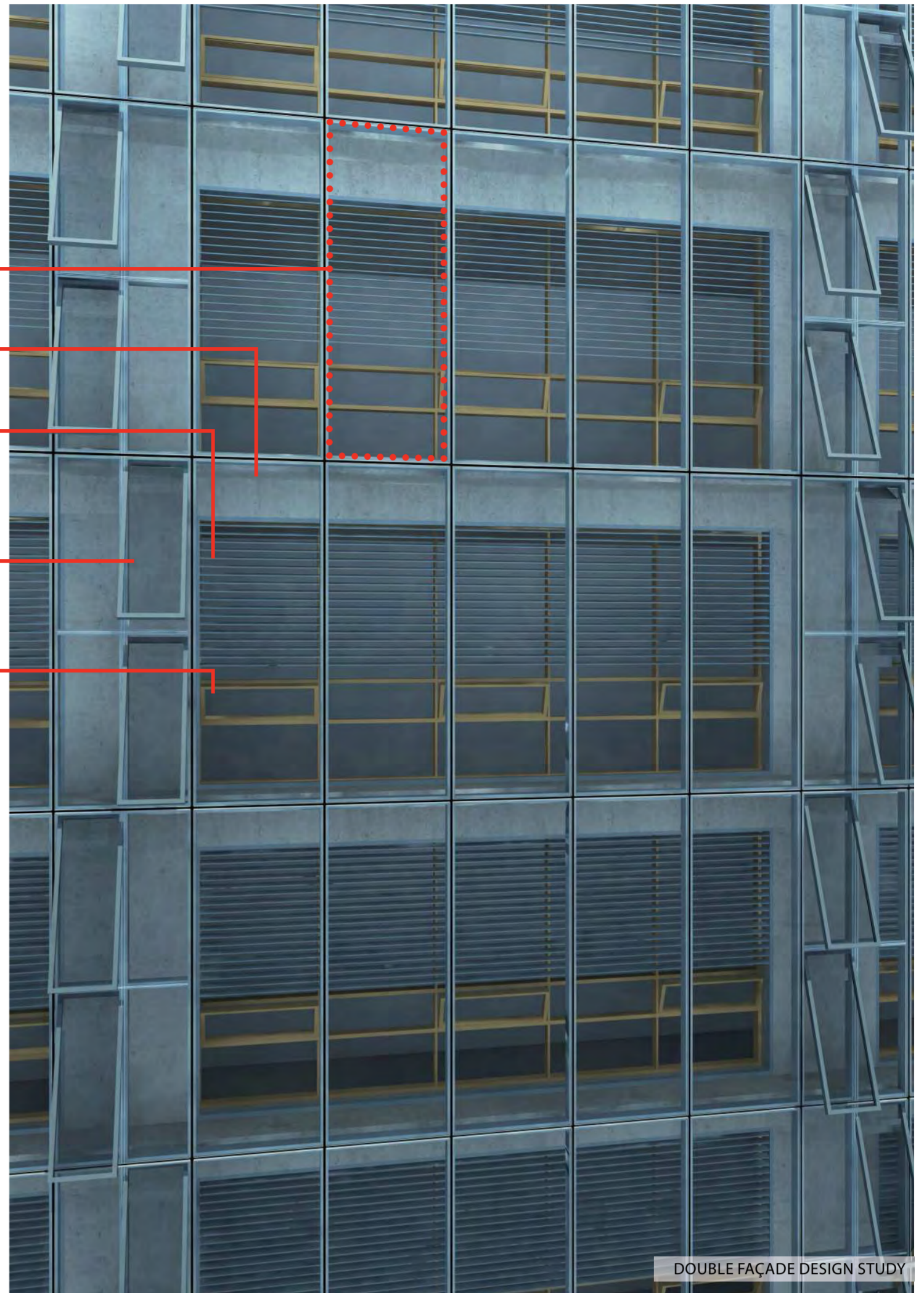
TRIPLE GLAZED

High performance triple glazed unitized curtain-wall assembly and opaque ceramic frit pattern over the south façade of the tower, helps minimize solar heat gain into the office space.

Motorized roller blinds control solar heat gain and glare for south facing office spaces. The use of a metallized low VOC fabric reflects heat back out of the building while allowing the use of a darker fabric for the interior surface to optimize views out.



TRIPLE GLAZED SOUTH FAÇADE CONSTRUCTION PHOTO



DOUBLE FAÇADE DESIGN STUDY

64% ENERGY SAVINGS, 64,800 S.M., 100% FRESH AIR 24/7/365 DAYS A YEAR

The exterior curtainwall is comprised of 4-sided structural silicon glazed aluminum frame unitized panels. Stringent specifications determined a good thermal resistance and tight envelope for an extreme climate. Here, the use of 4-sided SSG glazing eliminated the need for thermal connections through the framing, improving performance.

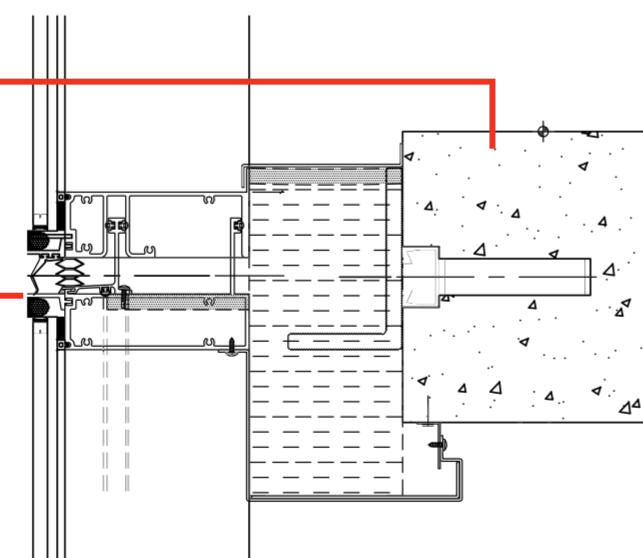
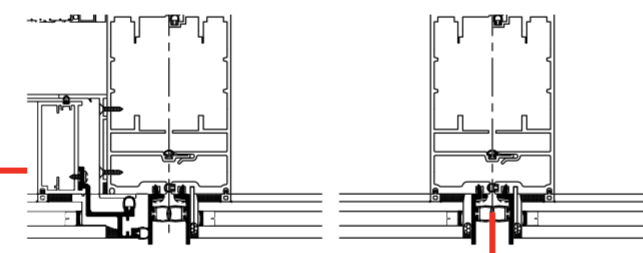
Custom designed vents maintain a tight seal to minimize energy losses due to exfiltration/infiltration.

Extruded silicone gaskets were used in lieu of the more standard EPDM (ethylene propylene diene monomer) rubber trim gaskets for an increased durability and lifespan of the system.

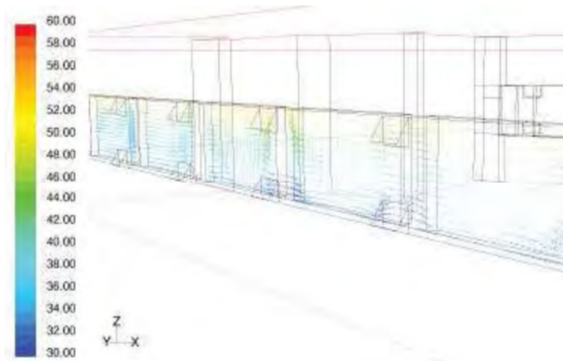
The exposed concrete slabs within the cavity utilize radiant hydronic heating tubes, to maintain minimum temperature values in winter. In summer these loops are used as solar thermal collectors, storing the heat in the Geothermal field below the building.

Exposed exterior trim elements were fabricated from an extruded acrylic styrene acrylonitrile (ASA) product, providing a superior thermal performance over aluminum with an easier workability over fiberglass.

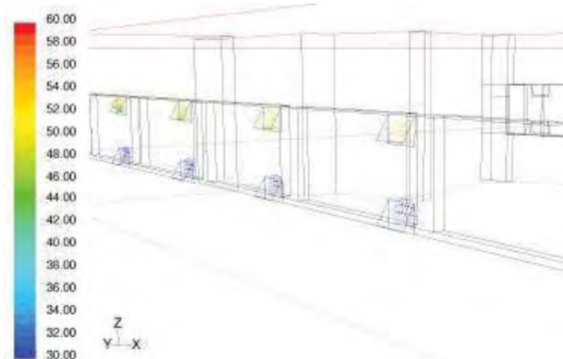
DOUBLE FACADE MULLIONS



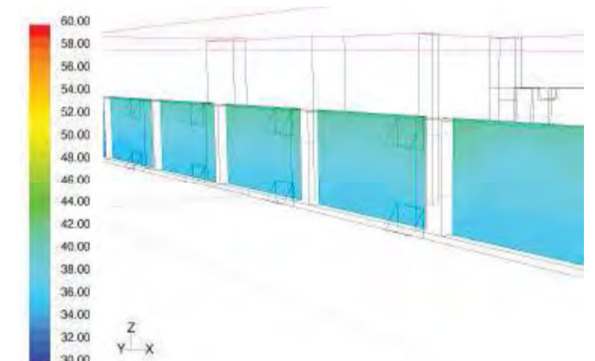
CFD ANALYSIS OF DOUBLE FACADE



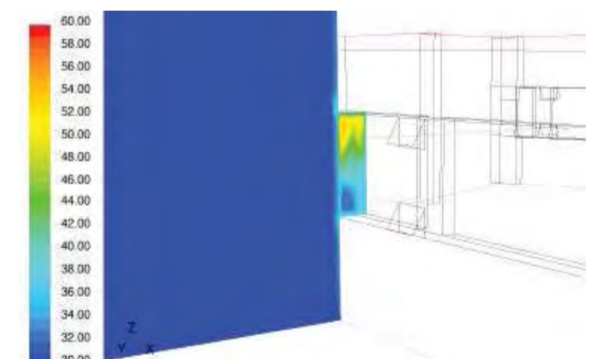
LONG SECTION
ARROW LENGTH ACCORDING TO VELOCITY



AIR FLOW AT OPENINGS
ARROW LENGTH ACCORDING TO VELOCITY



SURFACE TEMPERATURES OF SINGLE GLAZING



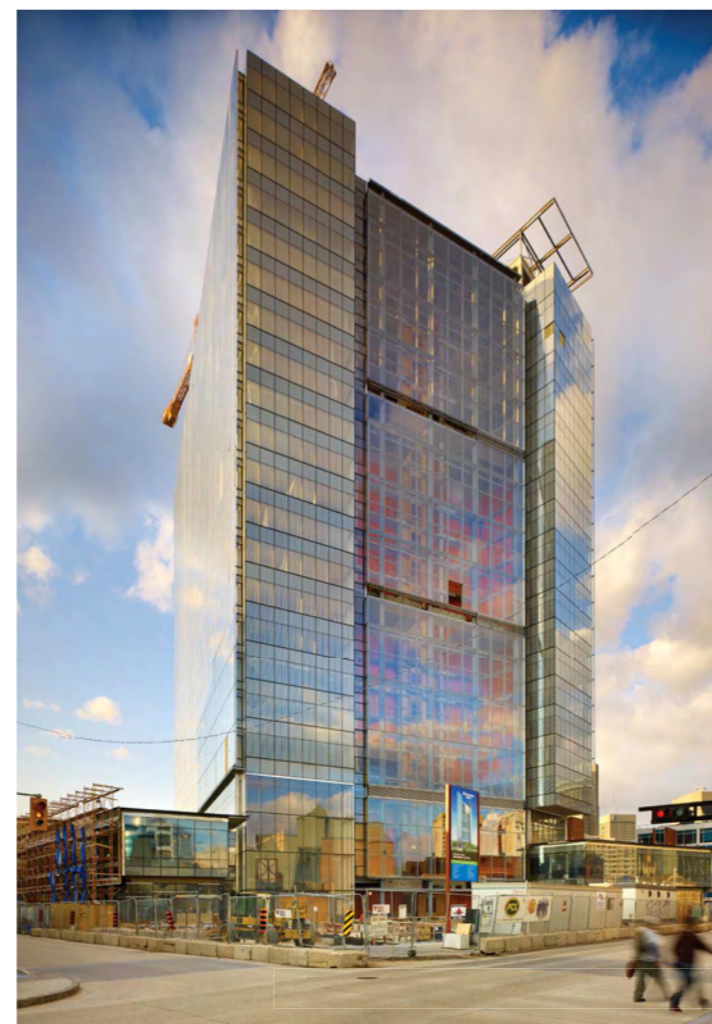
CROSS SECTION - FAÇADE CAVITY TEMPERATURES

A CFD analysis was performed using a worst case scenario (high solar radiation coupled with low winds) that actually does not occur within the CWEC weather data. Stacked awning vents proved the most effective approach.

Project Facts and Credits

Client
Manitoba Hydro
Site
360 Portage Avenue, Winnipeg, Manitoba
Program
22-storey high-rise office building to house 2000 workstations for 2000 employees. Three-storey podium base contains retail; one level of parking below grade
Size
64,800 m²
Completion Date
May 2008: Fast track delivery for construction in 2.5 years
Budget
\$278 million project cost inclusive of base building and interior fit-up, professional services, information and technology, communications and security infrastructure, furniture, and interest on capital
Integrated Design Team
Manitoba Hydro
Tom Gouldsbrough
Doug McKay
Kevin Leung
Colleen Johnson
Tom Akerstream
Julie Gervino
Leah Rensfelt
Susan Aird
Darren Sachvie
Carmen Hebert
Roberta Radons
Architects
Kuwabara Payne McKenna Blumberg Architects, Design Architects
Smith Carter Architects and Engineers, Architects of Record
Prairie Architects Inc., Advocate Architects

Engineers and Consultants
Transolar (energy/climate)
Yolles / Crosier Kilgour & Partners Ltd. (structural)
Earth Tech Canada Inc. (ET Winnipeg) (mechanical & electrical)
Groundsolar Energy Technologies (geothermal)
Omicron Consulting Group (geothermal)
Pivotal Lighting Design (lighting)
Hilderman Thomas Frank Cram (landscape)
Phillips Farevaag Smallemberg (landscape)
Leber Rubes (life safety)
Brook Van Dalen & Associates (building envelope)
Soberman Engineering (vertical transportation)
Aercoacoustics (acoustics)
RWDI Inc (microclimate)
Hanscomb (quantity surveyor)
Wardrop Engineering (municipal and site services)
ND Lea engineers & planners (traffic/access/parking engineer)
Uma Engineering Dyregreg consultants (geotechnical engineer/hydrogeologist)
Dan Euser Water Architecture (water feature consultant)
Ferguson Neudorf Glass Inc. (exterior facade fabricator)
Border Glass + Aluminum (exterior facade fabricator)
Images
KPMB using Revit, 3d Studio Max and Adobe Photoshop
Daylight Study and South Atrium Model: built by Richard Unterthiner
Model Photography: Tom Arban, Robert Hill, John Peterson



SOUTH ATRIUM DOUBLE FAÇADE

The south and north atriums are enlarged versions of the double façade cavity and are used as the supply and exhaust air collectors for the building.

Once in the atrium space, the air is further conditioned by a tall water feature (tensioned mylar ribbons with conditioned water running down each strand) before being drawn into the office's raised floors - chilled water dehumidifies the air in summer and warm water humidifies in winter.

A formed aluminum light shelf located at the top level of each south atrium, bounces light deep into the topmost level of each six storey neighbourhood.

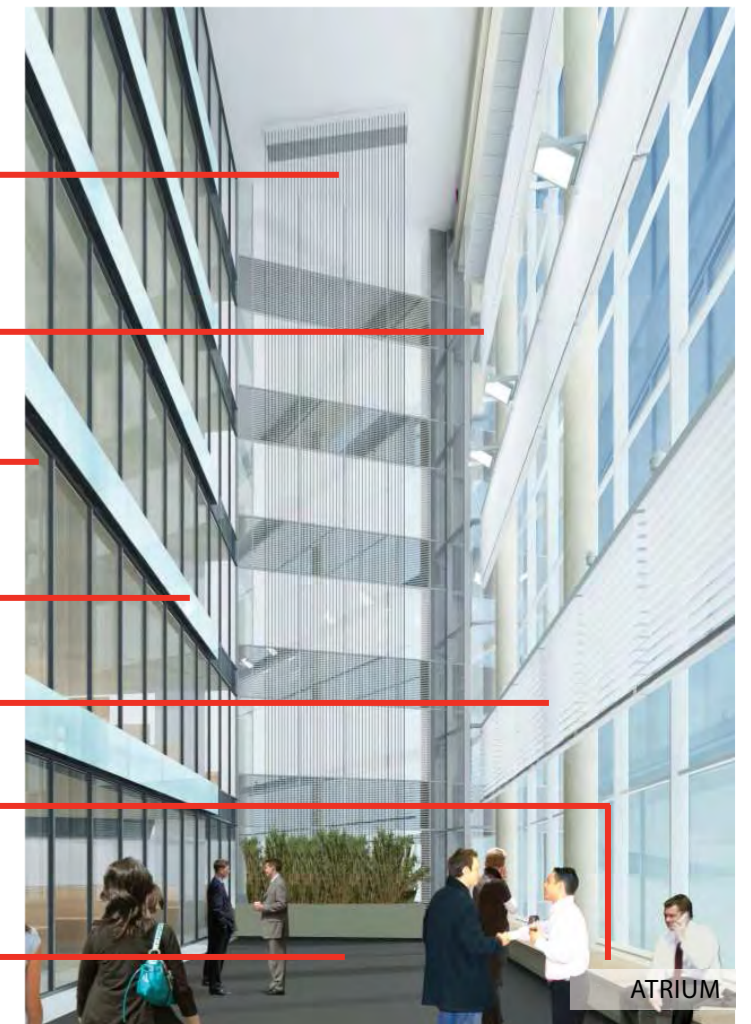
Interior curtain-wall (single glazed curtainwall assembly) separates South and North Atrium volumes from adjacent office space. A single pane glass wall with a pyrolytic low-e coating mediates temperature differences between office and atrium, while permitting maximum daylight into the workspace.

Framed Glass projections at each floor level draw air into the raised access floor plenums for distribution to the office space.

Automated 150mm wide louvre blinds control heat gain in the atriums during summer (encouraged in winter and shoulder seasons) while redirecting daylight further into the office space.

A mechanical bench at the base level of each South Atrium preheats 100% fresh air entering into the atrium in winter. In summer and shoulder seasons the air is drawn in through motorized operable vents in the exterior curtainwall.

A dark concrete floor, with hydronic heating loops, collects solar energy and preconditions the air in winter, while in summer it collects and exchanges the air borne heat with the buildings geothermal mass.



ATRIUM