Early 20th-century office buildings like Toronto's Birkbeck Building on Adelaide Street East were designed to work with the elements of nature, not against them. (Photo circa 1920.)

Les immeubles à bureau du début du 20e siècle, comme l'édifice Birkbeck de la rue Adelaide Est à Toronto, étaient conçus de façon à tirer parti des éléments naturels plutôt que d'y faire obstacle. (Photo prise vers 1920)

Photos courtesy of the Ontario Heritage Trust

Sustainable By Design: Tricks of An Old Trade

by Romas Bubelis

Sustainability and architectural conservation are often considered to be mutually exclusive. One is concerned with ethics, innovation and the future, and the other with old, anachronistic buildings at odds with the technological sophistication needed to achieve environmental sustainability. This polarized view overlooks the complexities of building in a sustainable way and the lessons that can be learned from the past as we move forward into the future.

From about 1880 to 1915, multi-storey commercial buildings made possible by elevators still relied primarily on natural ventilation and light. Like individuals with a waste-not-want-not philosophy, buildings of this era exhibit a practical attitude to environment that is rooted in common sense. Even large commercial buildings were designed to meet the realities of climate and site in a way that made them work with the elements, not against them. Technology that eventually made it possible to ignore such factors was not yet available.

The Canadian Birkbeck Building in Toronto is an Edwardian office building, national historic site and headquarters of the Ontario Heritage Trust. Built in 1908, its approach to environmental control was unselfconsciously green. Although electricity was available at the time, it was privately controlled and unreliable. Mechanical ventilation was limited to ceiling fans. Air conditioning did not make an appearance until 1915, and the chiller that provided cooling for large occupied spaces was not introduced until the mid-1920s.

The Birkbeck Building as seen today. Its dignified façade indicates the importance of the company headquarters, but also reveals something about the way the building was intended to function.

L'édifice Birkbeck aujourd'hui. Son élégante façade révèle son importance comme siège d'entreprise, mais aussi la façon dont ses concepteurs ont prévu qu'il fonctionne.

The 1908 Birkbeck Building's layers of frosted partitions allow light to filter into its interior spaces.

Dans l'édifice Birkbeck de 1908, la lumière traverse de multiples cloisons givrées pour parvenir aux espaces intérieurs.

Light and the Natural Window

The Birkbeck Building reveals how important natural light was as a design factor in the early 20th century. Its interior spaces were primarily lit by natural light and only supplemented by artificial electric light.

Different sized windows punched through the building's brick elevations take orientation into account to maximize the intake of natural light. To control excessive heat in summer months, those with southern exposures were equipped with shading devices such as roller blinds and awnings that were actively adjusted seasonally and daily.

The importance of light infiltration also determined ceiling heights. The ground floor, where the light condition is least adequate, has a 20-foot ceiling with very tall windows and a mezzanine along the exterior wall to maximize day-lit floor space. The second storey is 13 feet high to accommodate large windows in rooms associated with prime walk-up tenant space. Typical upper floors have 11-foot ceilings, sufficient to light smaller offices.

In plan, the Birkbeck Building is open on three sides, a street frontage plus a side lane and a rear courtyard. There is an indented court facing west designed to catch late afternoon light, when it is most valuable and difficult to obtain. Large sash windows light either end of the corridors. The windows along the perimeter wall admit light into the private offices whose frosted glass partitions allow it to penetrate into the general office area beyond.

The public corridor is similarly lined with large frosted glass panels affording privacy while allowing light to filter through. Less used ancillary spaces such as stairs, washrooms and storage vaults are relegated to the darkest portion of the floor against a blank party wall.

Natural Ventilation

Being able to control natural ventilation was another important design factor. Hot water radiators were the only source of heat, with no mechanical cooling devices. Heating was kept to a minimum in utilitarian corridors, stairwells, washrooms and vaults. The corridors have operable windows at either end to provide cross-ventilation for cooling, acting as a large central duct on each floor.

The interior walls contain a variety of transom panels each with its own manual rod-and-clamp or pulley controls. Like multiple baffles, they can be adjusted to channel air between office and corridor. The perimeter windows are true double-hung units designed for ventilation. The top sash is lowered to expel warm air at ceiling height and the lower sash is raised to admit cooler air. Air exchange is achieved by natural convection. There is a great variety of other casement, pivoting and awning windows and removable sash panels at the Birkbeck—each one visually appealing while also allowing occupants to directly modify their environment.

Sustainable By Design

In spite of these light and ventilation advantages, heritage buildings continue to be dismissed as unsustainable in terms of lifetime operating costs. What is often overlooked, however, is the value that a heritage building's embodied energy brings to the equation.

Embodied energy measures the true energy value of a material or architectural assembly over its life, the sum total energy needed to produce and operate a building over a certain period. It takes into account the

An awning window in the Birkbeck Building allows occupants to control their environment.

Une fenêtre-auvent de l'édifice Birkbeck permet aux occupants de contrôler leur environnement.

full life cycle of energy-consuming activities from raw material extraction and transportation to manufacturing, assembly, installation, maintenance, disassembly and demolition. A 100-year-old building like the Birkbeck represents the vast amount of energy expended on initial construction and the subsequent renovations and maintenance over the course of a century.

Most conventional environmental design evaluation systems, such as LEED (Leadership in Energy and Environmental Design), provide little credit for the adaptive reuse of existing buildings and the embodied energy they represent. The focus is primarily on new-build construction, generally favouring high-tech engineered solutions to energy efficiency problems.

Correspondingly, a tremendous amount of energy is expended to produce these new building materials, many of which are increasingly synthetic, made of composite materials and often transported long distances between extraction, manufacturing and construction sites. Stone, brick and timber, the local materials of traditional buildings, consume far less energy in their production than modern materials such as aluminium, glass, vinyl and other plastics.

Disposable Architecture

The embodied energy concept also exposes the true cost of the best and highest use paradigm of real estate development. Best and highest use is a concept for extracting maximum return on real estate investment and it relies on disposable architecture and an abundant supply of inexpensive building materials. BOMI (Building Owners and Managers International) typically considers this to be a 30-year cycle of demolition/new-build/demolition.

The Robertson Building (1913) on Spadina Avenue in Toronto was refurbished in 2004 to take advantage of natural light and ventilation.

En 2004, l'immeuble Robertson (1913) de l'avenue Spadina à Toronto a été restauré de façon à profiter d'un éclairage et d'une ventilation naturels.

In North America, the tax structure for appraisal and depreciation of real property assets supports this short life cycle for return on investment. But the environmental and energy costs of demolishing and dumping old buildings, then manufacturing and constructing new ones are a greater hidden cost.

The greenest building is the one you already have. Throwing out what exists and trading up to an energy-efficient product that is more disposable than what it replaced ignores half of the equation.

Enduring Architecture

The opposite of disposable building is what we might call enduring architecture. Those monumental buildings that symbolize our civic institutions, made of expensive, highly worked and durable materials like stone and bronze, created through craftsmanship, a generosity of material and meticulous, subtle detailing.

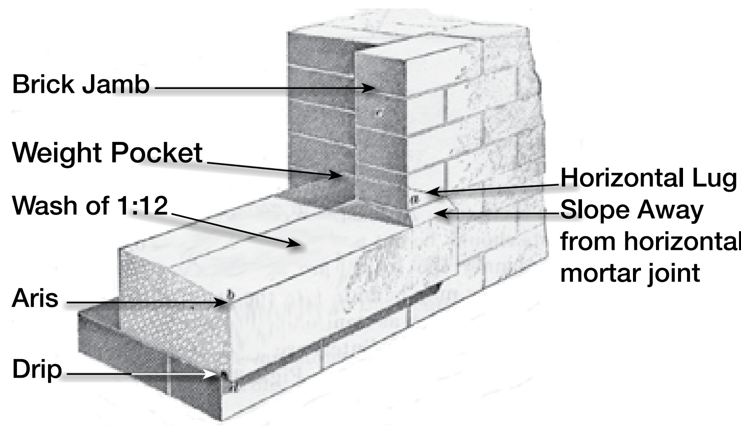
These buildings embody the Vitruvian concept of "firmitas"—individual stones that survive for generations with minimal changes save those of inevitable entropy. They age gracefully and accept surface patina created by oxidation, staining and differential weathering; the effect of nature upon architectural materials contributes to a building's inner character.

These qualities are closely associated with exceptional landmarks, but if we look at traditionally constructed commercial buildings, we find many of the same manifestations of durability and design for sustained use.

In Canada, most heritage commercial buildings date from the 19th or 20th centuries. They are transitional buildings, constructed of industrially produced materials using Victorian-era technologies, but still drawing inspiration from pre-industrial European Classical and Gothic building designs and craft traditions.

We only need look at the traditional window to find an example of subtle detailing designed to endure the elements. There were commonly held conventions regarding window design in the pre-curtain wall era. A stone or brick lintel spans an opening. Its size and proportion are determined by the position of the window within the façade composition. The jamb stone or brick reveal forms a recessed edge along the sides of the opening. The masonry jambs sit on a lug at either end of the stone sill. The lug has a flat surface to evenly carry the structural load of the masonry jambs and a bevel to shed water down the jamb and away from the vulnerable horizontal end joint.

The Traditional Window



Between the lugs, the length of the sill has a wash or slope of about one inch per foot. The underside of the sill has a drip to keep water from trickling down the wall surface. The wood frame with a weight pocket is tucked behind the masonry reveal, projecting into the window opening sufficiently to accommodate wood mouldings to cover joints. The frame has a sloped wood sill to channel away water running down the glazing.

These are the standard features of traditional window design commonly applied by architects and trades people of the day. They recognize the inevitable forces of gravity, weather and aging. The intention was to create something durable in the face of these realities.

Durability Through Change

Heritage buildings often undergo change to accommodate new uses, extending their durable qualities over time. Although new additions, alterations and overlays impact a building, ultimately they act to preserve it and to add new layers of architectural complexity.

The block at Adelaide Street East and George Street in Toronto is a case in point. At one corner stands the former Bank of Upper Canada, built in 1827 over the ruined vaults of a previous structure. It was the only bank in Upper Canada and the power base of the Family Compact. At the other corner stands the Georgian house of James Scott Howard, Toronto's first postmaster, built in 1833. In between is the Victorian-style De La Salle Institute, dating from 1870, that eventually absorbed the other two buildings by extending its third storey and mansard roof over them.

An interior and exterior view of giant semi-circular horizontal windows which swing open on their central pivot. Not only are they visually appealing, they are functional, allowing occupants control over ventilation.

Thereafter, this complex served as a residential school, school board head office, biscuit company office, processing plant of the United Farmers' Co-operative and headquarters of their political wing before it was saved from demolition and rehabilitated as a heritage office building in the 1970s.

Today the life of a contemporary office goes on amongst pieces from the past—studded heavy timber security doors of the old bank, a delicate Georgian fanlight, basement vaults, cast iron columns of the main hall and an open upper floor behind a Victorian mansard roof.

The Palimpsest

It is this sort of endurance that reminds us of a palimpsest, one of the earliest forms of recycling. In antiquity, parchment made of animal skins was scarce and valuable and not something to be discarded. Old manuscripts, often Greek in origin, were scraped or rubbed away, rotated 90 degrees and then overwritten, leaving two or more layers of writing visible.

The palimpsest is an apt metaphor for a heritage building because in their fabric, these buildings make manifest the passage of time. They can remind us of things we have largely forgotten: how important natural day lighting and natural ventilation were in the past; how building materials and traditions once anticipated age and change; and that heritage buildings tend to prove that the most sustainable buildings of all are those that are built to endure.

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Vue intérieure et extérieure d'immenses fenêtres horizontales semi-circulaires qui s'ouvrent en pivotant sur leur axe central.

En plus d'être jolies, ces fenêtres sont fonctionnelles, permettant aux occupants de contrôler la ventilation.