1 case study The Friedman Building

> "Heritage is the essence of sustainability, it is a natural fit." Mark Ostry, Principal Acton-Ostry Architects

passive strategies
- **smart material selection**
- **daylighting**
- **efficient energy systems**

urban densification
- **creative recycling**
- **rethinking spaces**
- **prioritizing community**
- **sensitive adaptation**
- **balancing high performance + character**
- **retrofitting historic architecture**
- **green building rating systems**
- **adaptive reuse**
- **economic feasibility**

Much of our modernist heritage was built in a time when energy was cheap, active climatic controls common, and the economic functionalism of modular, mass production dominated over durability. These characteristics are opposite to what are today considered sustainable design: natural ventilation, passive thermal controls, and durable construction techniques. Originally built in 1961, the Friedman Building is a typical modernist building. Its successful 2008 rehabilitation shows that despite the short-term thinking of the era during which it was constructed, a sensitively designed retrofit can transform such buildings to suit today's users as well as fulfill contemporary notions of a sustainable building.

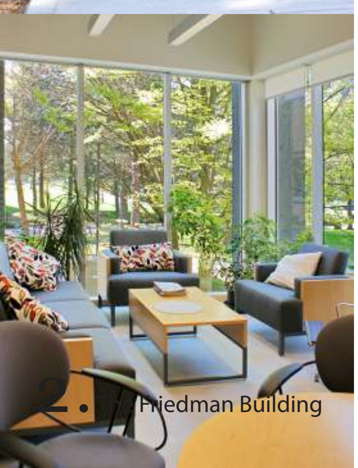
building at a glance

building name	Friedman Building
location	2177 Wesbrook Mall
size	6,250 m² (67,274 sf)
original building	1961/1967
rehabilitation	2008
original use	Department of Anatomy teaching and research labs
new use	Department of Physical Therapy, School of Audiology & Speech Sciences teaching and research labs
cost	$19 000 000

building team

owner	UBC
architect	Acton-Ostry Architects Inc.
contractor	The Ledcor Group of Companies
electrical engineer	MCW Consultants
mechanical engineer	MCW Consultants
landscape architect	PhillipsFarevaag SmallenbergInc.
structural engineer	Read Jones Christoffersen Ltd.
commissioning agent	Western MechanicalServices (1977) Ltd.
building envelope	Read Jones Christoffersen Ltd.
sustainability + LEED	Recollective

The Friedman project converted medical labs and teaching rooms into a new home for the Department of Physical Therapy and School of Audiology & Speech Sciences. The new space is composed of large, bright teaching spaces and faculty offices connected by articulated circulation elements featuring social spaces and breakout seminar rooms. Targeting LEED-Gold, the rehabilitation project is a credit to both Acton-Ostry Architecture and UBC. Importantly, the project was a part of the UBC Renew program, an innovative financing model that is able to produce like-new buildings in existing structures, not only preserving the campus' heritage assets but also greatly reducing deconstruction waste and saving the university millions of dollars in capital construction costs.



Modernist architecture is not suited to be restored to its original condition. It is best to rehabilitate or renovate using best practices in sustainable design while integrating its heritage character. The Friedman project is an excellent example of how we can respect the heritage aspects of a modernist building while still pushing our built environment towards a more sustainable future.

defining terms:

Preservation: The process of protecting, maintaining and stabilizing the existing materials, form, and integrity of a historic place, while protecting its heritage value.

Rehabilitation: The process of making possible a continuing or compatible contemporary use of a historical place through repair, altherations or additions, while protecting its heritage value.

Restoration: The process of accurately revealing, recovering or representing the state of a historic place, as it appeared at a particular period in its history, while protecting its heritage value.

Standards and Guidelines for the Conservation of Historic Places in Canada, Parks Canada [2003]

history


ViewofMedicalSciencesBuildingsfromWesbrookBuilding_1962

Like many North American universities, the University of British Columbia underwent a dramatic post-war expansion as a result of demographic pressure. In 1950, the recently founded Faculty of Medicine hired a young Dr. Sydney Friedman to head the newly formed anatomy department. Initially, the Faculty of Medicine was housed in converted army hut near the centre of campus. A committee advocating a more permanent solution was quickly convened, with representatives from all departments, including Dr. Friedman. Goals for the new "Medical Sciences Buildings" included:

- an on-campus location close to the future hospital
- buildings that are "economically and realistically planned to give maximum floor space for the available funds"
- buildings "designed in such a manner that small or large units can be added from time to time at minimum cost."

'Sustainability', with all of its contemporary meanings was not a factor; rather, the buildings had to be expandable, economically efficient and on-campus. An early attendee of these meetings was Fredrick Lasarre, the head of UBC's newly formed School of Architecture. He suggested that a "generous" budget of $20/sf would include furnishings, site work as well as construction. Initial plans for the Medical Sciences complex included departmental teaching space, administrative offices, four 120-person lecture halls, a medical library and a student lounge. Consequently, the UBC Board of Governors set aside two million dollars for the project.

Over the following years, five separate schemes were suggested by university architects Thompson Berwick and Pratt, ranging from a central tower surrounded by low-rise departmental structures to one large mat building containing the entire program. Costs mounted and the program had to be cut out, with a final scheme consisting of three very basic, modular, slab-shaped buildings aligned with University Boulevard. Exterior infill panels alternated between coloured porcelain panels, aluminum windows and some glazed brick. Interior finishes were limited to painted concrete block, basic resilient flooring, and acoustic ceiling panels. The large lecture halls and administrative space had been cut, as well as the library and student lounge. Despite this, the estimated cost for this truncated scheme had climbed to $2.9 million, even with only 80% of interior spaces finished. In spite of these concerns, the project was approved for tender by President Norman Mackenzie and the Board of Governors in the fall of 1959.

Further cuts were forthcoming. By the time the project had been completed in 1961, even the venetian window blinds had been removed to allow for the painting of the concrete block. Indicative of the quality of original materials and finishes is the phrase, "Don't ask us why the buildings are so ugly -- ask the architects", found at the bottom of a temporary departmental directory dating from the opening of the building.

The addition of a library, dentistry building and lecture hall were carried out between 1961-1967, with the whole complex being connected by 1976. In 1981 the Medical Sciences Building Block "B" was renamed the Friedman Building.

Architectural rendering_1959


Sitework with a view of the Gymnasium_1959


Block C under construction_1960


Woodwards Biomedical Library_1963

- 1949 — UBC faculty of medicine founded
- 1955 — Medical Sciences Buildings proposed
- 1959 — Construction begins
- 1961 — Medical Sciences Buildings opened
- 1964 — Woodwards Biomedical Library expansion opened
- 1967 — JB Macdonald Dentistry Building opened
- 1981 — Medical Sciences Building Block C renamed the Friedman Building
- 2008 — Acton-Ostry led renewal project complete

retrofitting modernism

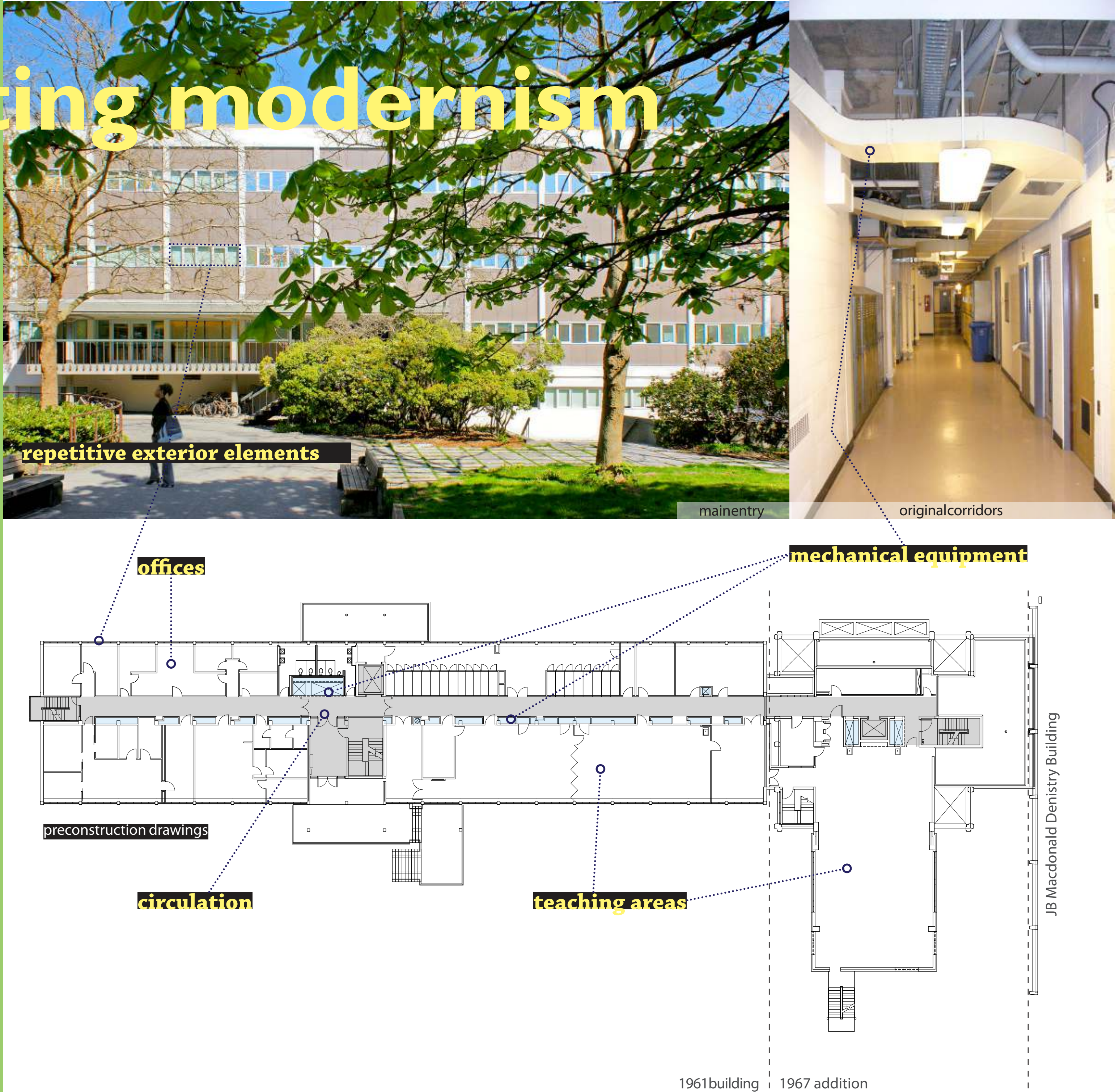
In 1946, Fredrick Lasarre wrote that Thompson Berwick Pratt must "decide between (an) imitation gothic and frankly and honestly modern"[1] architecture for the UBC campus. The 'gothic' style is characterized by heavy masonry and was the dominant pre-war architectural influence at UBC. However, following the over-budget 1945 Hennings Building and the rising cost of masonry construction, the simplified forms and economic imperative of the new modernist movement were endorsed by UBC.

The Modern period of architectural production is considered to be between 1940-1975. Following the mantra "one world, one climate" and the lure of seemingly limitless cheap energy sources, buildings from this period are considered to be the biggest energy hogs in the built environment.[2] The Friedman Building was completed in 1961, and as such is reflective of this time. Modernist, institutional architecture is characterized by repetitive, modular elements, expanses of single glazed metal-framed windows,

1 Thompson Berwick Pratt fonds, UBC archives
2 National Parks Service US: Preservation Brief 3: Conserving Energy in Historic Buildings. [USA] NPSUS Department of the Interior. 2008

modernism

An architectural movement that occurred between the 1930s and 1970s. Characterized by a belief in the power of architecture to cause positive social change through the application of industrial techniques of invention, mass production, modularity and efficiency.



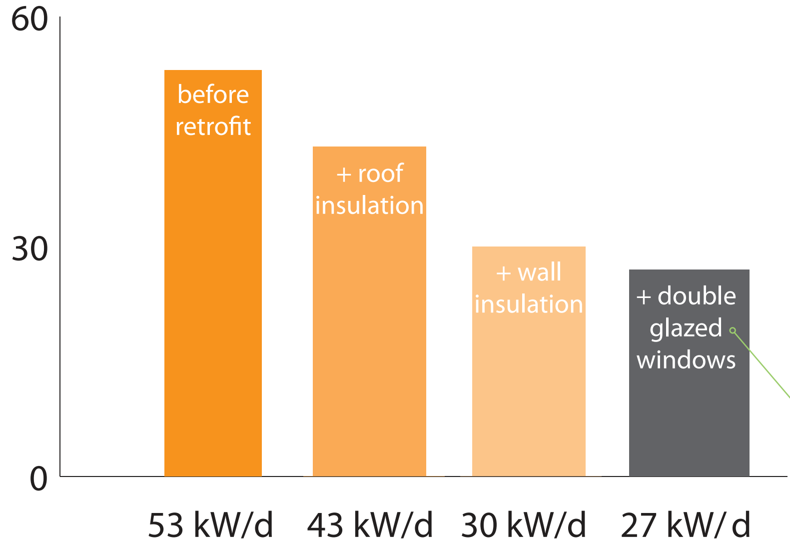
preconstruction drawings

a focus on economic efficiency and industrial means of production and a heavy reliance on artificial, forced air temperature and ventilation systems over natural ventilation or radiant heating.

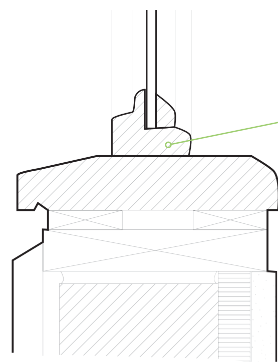
Curiously, these characteristics of modernism also make rehabilitations a logical fit with contemporary notions of sustainability. Narrow concrete or steel floorplates offer good opportunities for natural ventilation and daylighting while concrete structures allow more flexibility in space planning than load-bearing brick or masonry walls. Modular elements mean a solution can be repeated again and again, allowing economies of scale to reduce the cost of a retrofit. Inefficient, aluminum windows can easily be replaced with updated, double glazed, thermally broken versions that mimic the minimalist profile of the original. As architect Mark Ostry says: "Maintaining wood windows should be not a question; but is there culture in aluminum windows?". Forced air systems can be retrofitted with more efficient boilers, heat recovery units, or with hydronic, radiant heat panels.

In the case of the Friedman Building, the regular, rectangular shape and concrete structure allowed the interior layout to be dramatically altered to reflect the needs of the new School of Audiology and Physiotherapy. Mechanical system upgrades were an easy energy-saving decision, and new windows meant a tighter, more comfortable building delivered on time and on budget.

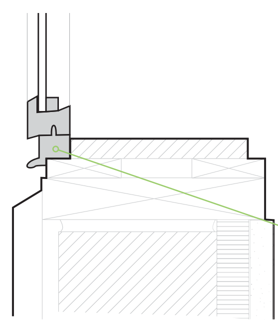
energy reductions achieved through retrofitting



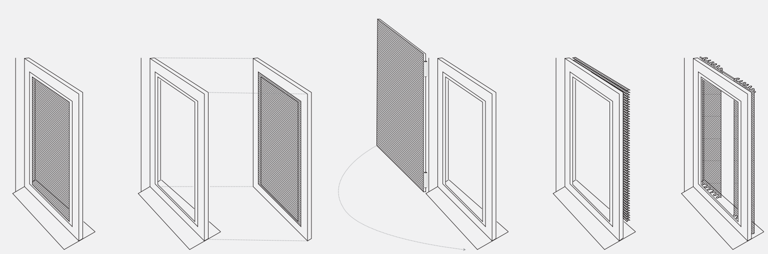
kilowatt/day per person (kW/d) power usage based on average, uninsulated detached home (David Mackay, 2009. withouthotair.com)



typical wood frame profile



typical aluminum frame profile



modernism, windows, and heritage

THE QUESTION

Is it best practices to replace and landfill or rehabilitate the existing windows in a heritage project?

CONSIDERATIONS

What is the existing window's embodied energy?
How do windows define a building's character?
What are the potential energy savings?
Will replacement windows diminish maintenance costs?
How long will the new windows last vs. the existing units?
Are there alternate ways to achieve energy efficiencies?

GLAZING

Replacing single-pane with double-glazing is a common energy-saving strategy. However, the actual energy savings vs. the production energy of the new window are so incremental that it is often better to simply retrofit a storm window or a second layer of single glazing to the existing glazing units.

WOOD FRAMES

Generally speaking wood windows are worth repairing and selectively rehabilitating before replacing with new units. If replacement is necessary, use wood over PVC products. Properly maintained wood windows can last 200 years or more, at which point the wood is able to decompose and re-enter the biosphere.

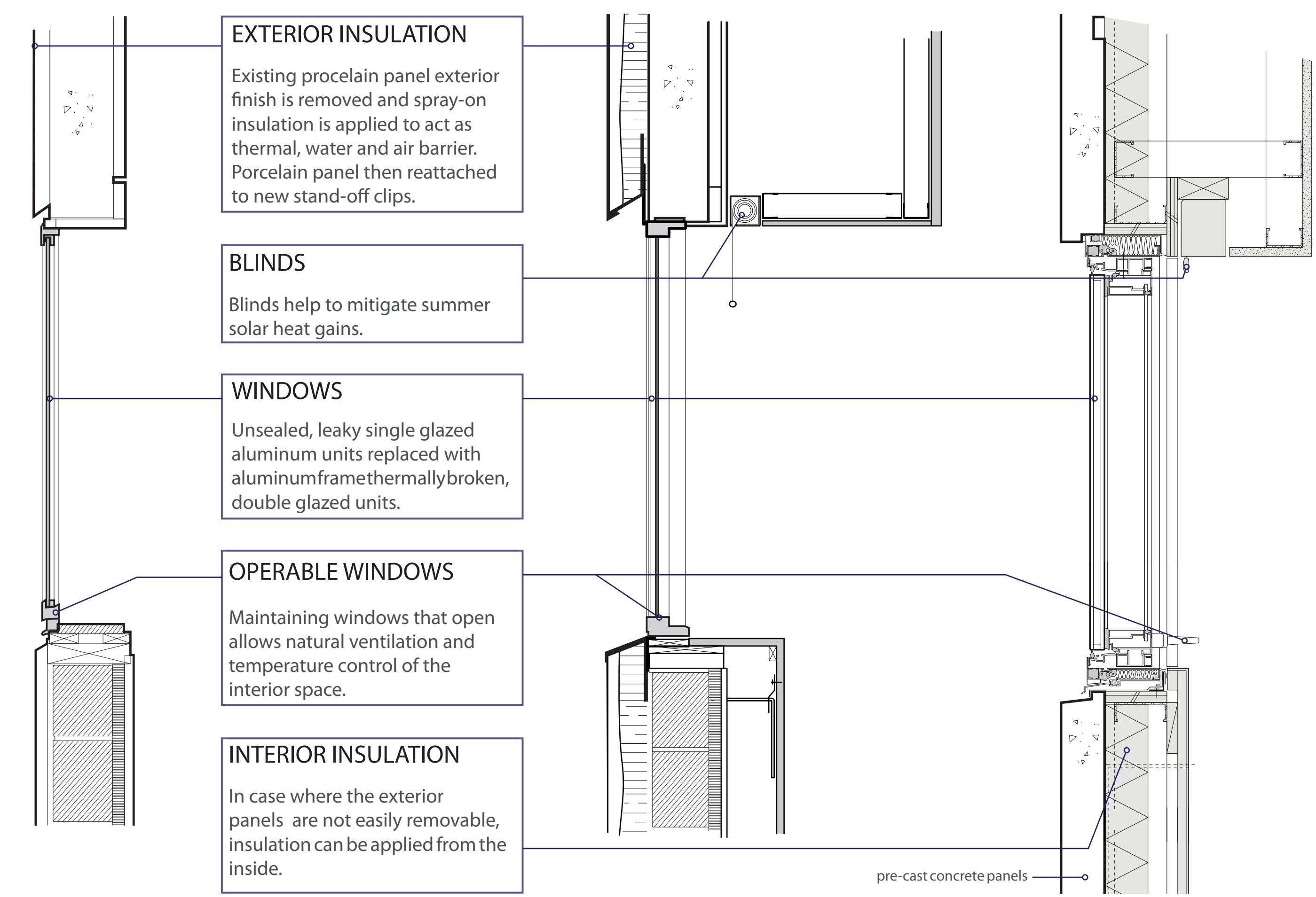
STEEL OR ALUMINUM FRAMES

Steel or aluminum frame windows may be worth rehabilitating, although the inherently poor thermal qualities of steel and aluminum can make meeting contemporary energy-efficiency standards difficult. Replacement with thermally broken, double glazed units may be the best option.

ALTERNATE ENERGY STRATEGIES

Re-sealing, adding a low-emissivity film, storm windows, installing shutters, blinds, or curtains are alternate strategies to increase the thermal performance of your glazing.

modernist facade retrofits: the Friedman Building



EXTERIOR INSULATION

Existing procelain panel exterior finish is removed and spray-on insulation is applied to act as thermal, water and air barrier. Porcelain panel then reattached to new stand-off clips.

BLINDS

Blinds help to mitigate summer solar heat gains.

WINDOWS

Unsealed, leaky single glazed aluminum units replaced with aluminumframethermallybroken, double glazed units.

OPERABLE WINDOWS

Maintaining windows that open allows natural ventilation and temperature control of the interior space.

INTERIOR INSULATION

In case where the exterior panels are not easily removable, insulation can be applied from the inside.

definitions

AIR INFILTRATION

The most effective strategy to reduce heat loss in an older building is to reduce air infiltration, or drafts. Rather than replace windows, try sealing and repairing them with weather stripping or new hardware. (TheGreenGuidetoHistoricBuildings,Prince'sRegeneration Trust, 2010)

LIQUID WATER BARRIER

It is important to keep liquid water from penetrating and soaking into the building's envelope as it can cause rot, mould and greatly contribute to the deterioration of a building. Typically this function is performed by a building's cladding, although is important to detail any openings like windows or doors properly.

AIR/MOISTURE BARRIER

An air/moisture barrier is the material that mitigates air infiltration-related heat lossess. The most common materials used are plastic sheeting, although there are numerous other means to achieve the effect such as sealed drywall or plywood.

SOLAR HEAT GAIN

When the sun's radiation directly hits a window, a portion of the heat is deflected and absorbed by the glazing. Once the radiation encounters an object inside the room, it changes shape into long-wave radiation, which is unable to penetrate glass. This heat stays in the room, like in a greenhouse. This is solar heat gain.

Shading the Friedman Building_1955

'Brise-soliel' or sun-shade louvres were popularized by architect Le Corbusier in the 1933 to offset the solar heat gain caused by modernism's large expanses of glass. In 1955, the Friedman project considered their use.

March 20: Louvred sun shades, "like in Europe and South America" is suggested

March 24: Alsco aluminum products rejects sun shade design as "not effective and not economical"

1956

Sept 21: Sunshades to cost $20 000.

Oct 19: Energy study recommends sun shading

1959

Oct 22: TPB suggests sunshades "aesthetically complicate facade" and should be excluded

Dec 17 : Project tendered with sun shades

1960

Feb 18: Tenders are over budget, sun shades cut from project

LEED+ heritage

The renewal of the Friedman Building is poised to become among the first modernist heritage buildings in Canada to achieve the Canada Green Building Council's LEED for New Construction:Gold certification. UBC Renew design guidelines require LEED : Silver certification; the potential achievement of gold level is a bonus for the Friedman Building and Acton-Ostry Architects.

When considering heritage projects, green building rating systems and heritage rehabilitation are often at odds. Rating systems generally prioritize the quantitative aspects of 'high-performance' and energy efficiency over the more qualitative, social and cultural aspects of a heritage building.[1] Little or no credit is granted to heritage projects that make the decision to maintain an existing structure or facade, especially given the greater immediate construction costs and design challenges that heritage rehabilitation can entail. This is despite the massive contribution heritage projects of all kinds make to the cultural memory and fabric of our built environment and diversion of waste from the landfill that are a part of keeping and an existing structure.

1 Kamin, Blair. "Historic Preservation and Green Architecture: Friends or Foes?", Preservation Vol. 62, No 2, March-April 2010: pp. 29-33.

physiotherapy lab

LEED cagbc.org

Leadership in Energy and Environmental Design. A credit-based green building rating system administered by the Canadian Green Building Council. Presently includes categories for New Construction, Existing Buildings, Commercial Interiors, Core and Shell, Neighbourhood Development and Homes.

reusing the existing building means:

11.5 million gigajoules of energy saved
822 tonnes of CO2 not emitted
1.5 million kg of waste diverted from landfill
560 000 kg of coal saved in the production process
500 000 L water saved in the production process

life cycle analysis and costing (LCA)

Life cycle analysis is a means of accounting for the cost and energy required to produce, maintain and dispose of a building or product. It includes the resources required for the manufacture, and the CO2 equivalent output, water and air pollution created by the production process. For buildings, tools such as the Athena Ecocalculator make the LCA process easier.

The Friedman energy model shows 284 GJ energy use and 73.4 tons CO^2 equivalent reductions/year as compared to the MNECB reference case.

Windows, envelope retrofitting, energy modelling and material lifecycle accounting form the heart of the conflict between heritage and many rating systems. From a technical perspective, replacing existing wood with new thermally-efficient vinyl windows offers only minor energy savings, while often comprimising the character of the building and creating an needless landfill waste. Inappropriately piling layers of insulation onto a facade diminishes the appearance of a building's history. The waste diversion and lifecycle replacement implications of not demolishing a perfectly functional structure are infrequently accounted for in green building rating systems. These type of conflicts - while common - are not always present.

For the Friedman Building, the decision to maintain the existing structure and facade rather than build new did offer some barriers to LEED certification, but with the creative resources of a dedicated design team and the intelligent support of sustainability consultants, Recollective, the process was relatively smooth. The LEED certification process for heritage is "easy if you are not lazy." says Mark Ostry. As with new construction, an early commitment to the process by the owners, design team and contractor is essential for heritage projects.

apples to apples: energy modelling for heritage

An energy model is not only a useful decision-making tool, but is also essential to the LEED certification process. However, a reliance on the guidelines set out by the Model National Energy Code of Canada for Buildings (MNECB) in the modelling process can create inaccurate results when applied to heritage buildings.

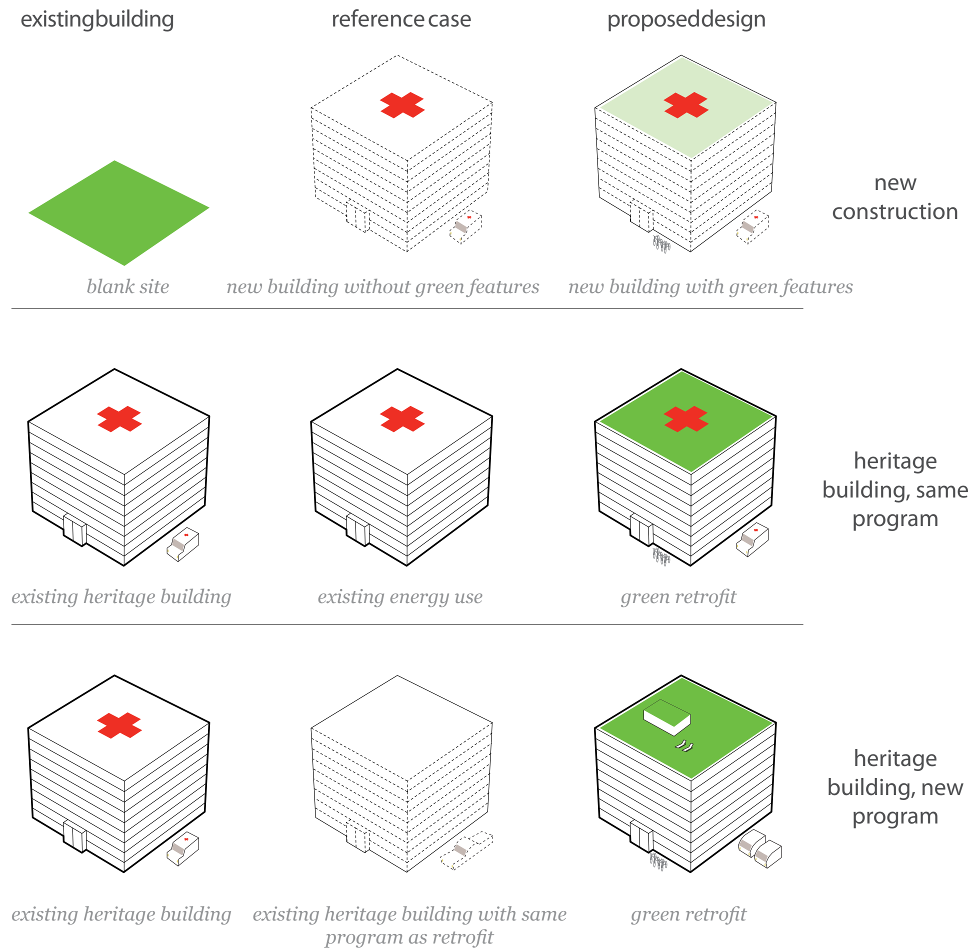
This is because heritage buildings often dramatically underperform when compared to the MNECB guidelines, and thus render a MNECB-based model highly inaccurate.

In some cases, existing building utility data can be used to create a baseline case. This is less useful when a building undergoes an extensive change of program and in fact can create misleading payback calculations (both negatively and positively).

A more accurate way of modelling a heritage building that changes program is to create a baseline case from similarly programmed buildings of the same era.

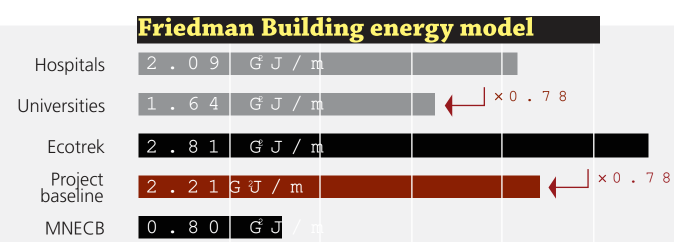
For the Friedman project, simply changing the program of the building from energy-heavy medical labs to less energy intensive classrooms and offices achieved a massive energy reduction in absolute terms. This makes the payback period for any new energy savings measures extremely short. However, this is only because the old building was so energy inefficient.

Instead, the design team compared the provincial average of energy consumption / area for today's medical labs to that of a university in order to determine a conversion factor. They then multiplied the conversion factor by the proposed baseline case to more realistically model a baseline condition.



energy modelling

Energy Modelling is a tool designed to assist owners and design teams make better decisions about a building. First, a theoretical reference building, incorporating the essential features of the proposed design, is modelled using software. Potentially energy saving decisions can then be compared to this theoretical model.

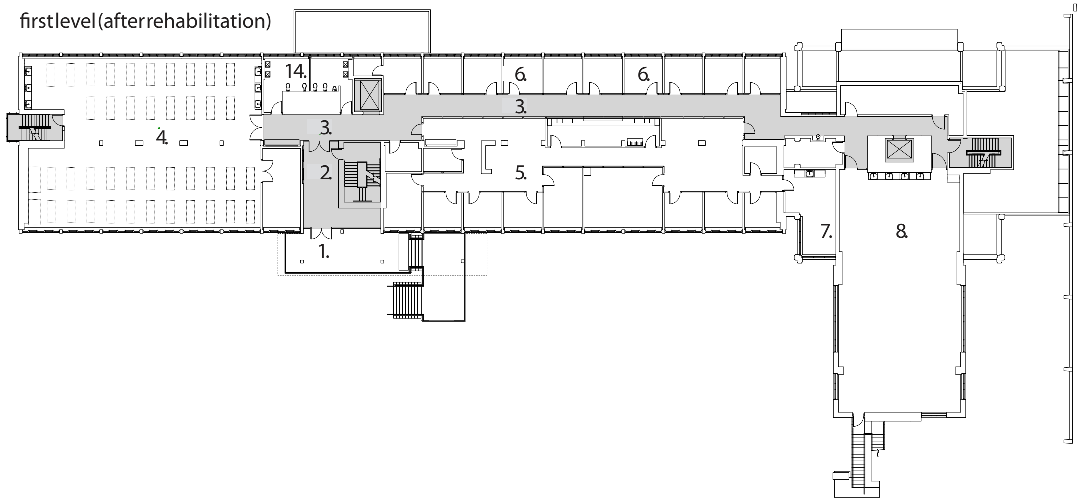


adaptive re-use

Originally, the Friedman Building housed numerous laboratories, teaching labs and offices for the Department of Anatomy and the Cancer Institute. Staff offices were located on the north side of the building to mitigate solar heat gain during the summer months, with teaching labs on the southern edge where solar gain would not affect the occupants during the colder winter months. Dividing the two spaces was a linear corridor, flanked by numerous floor penetrations for the gas, water and vacuum lines, mechanical ductwork and waste removal. Originally, this corridor was naturally lit from the fully glazed fire stairs at each end, but when the 1967 addition of the Woodward's Biomedical library closed off one end, this space became an artificially lit, institutionally unfriendly space.

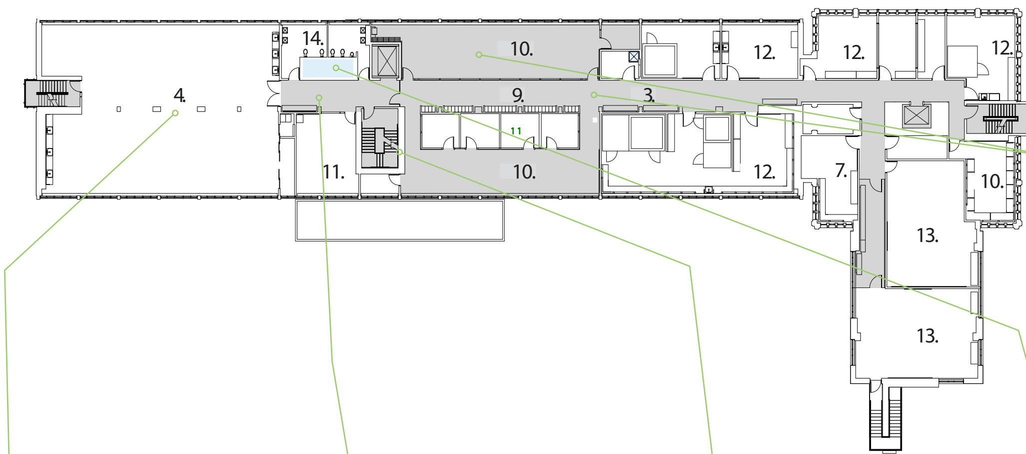
For Acton-Ostry, a corridor "should be more than a means of travelling through the building" and so they included social/study nooks by varying the corridor's width. To achieve higher daylight levels and to connect those working in the offices to the rhythms of movement and inhabitation taking place in the corridor, frosted glazing partitions were used between the offices and the corridor. The result is a pleasantly illuminated circulation space, punctuated by intimate study spaces.

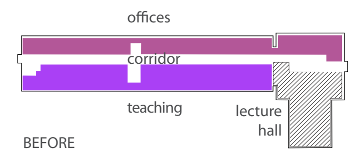
first level (after rehabilitation)



1. entry
2. lobby
3. corridor
4. physical therapy laboratory
5. administration
6. faculty
7. lounge
8. physical therapy exercise
9. lockers
10. study
11. seminar
12. audiology laboratory
13. classroom
14. washroom

second level





SOCIAL / STUDY / CIRCULATION

Opportunities for a community of students, staff and faculty are created by the articulation of the corridor and the introduction of study nooks.

STRUCTURAL FLEXIBILITY

The modernist concrete post and beam system allows large teaching spaces with a minimum of new load-bearing elements.

GLAZED PARTITIONS

Corridor space, previously an unfriendly, artificially-lit space is now illuminated through the glazed partitions that make up many corridor walls.

VERTICAL RETENTION

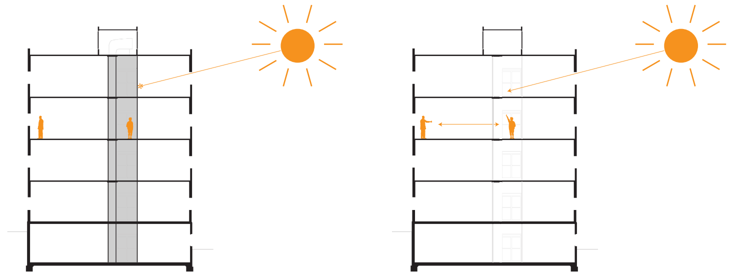
The basic form of the building allows new program to be seamlessly integrated into the existing staircases and elevator cores.

SPACEMAKING

The removal of much of the mechanical equipment opened up space for the new program.

The 1976 joining of the Friedman Building to the recently completed JB Macdonald Building shifted the centre of the building to the connecting wing and its large lecture theatre. Acton-Ostry's rehabilitation acknowledged this transition by opening up the east end of the building into large teaching spaces, balancing out the lecture space while creating a large, daylight space suitable for a variety of teaching functions.

open teaching areas



BEFORE - low daylighting, no connection between corridor and adajacent spaces

AFTER - daylighting, connection between corridor and adajacent spaces

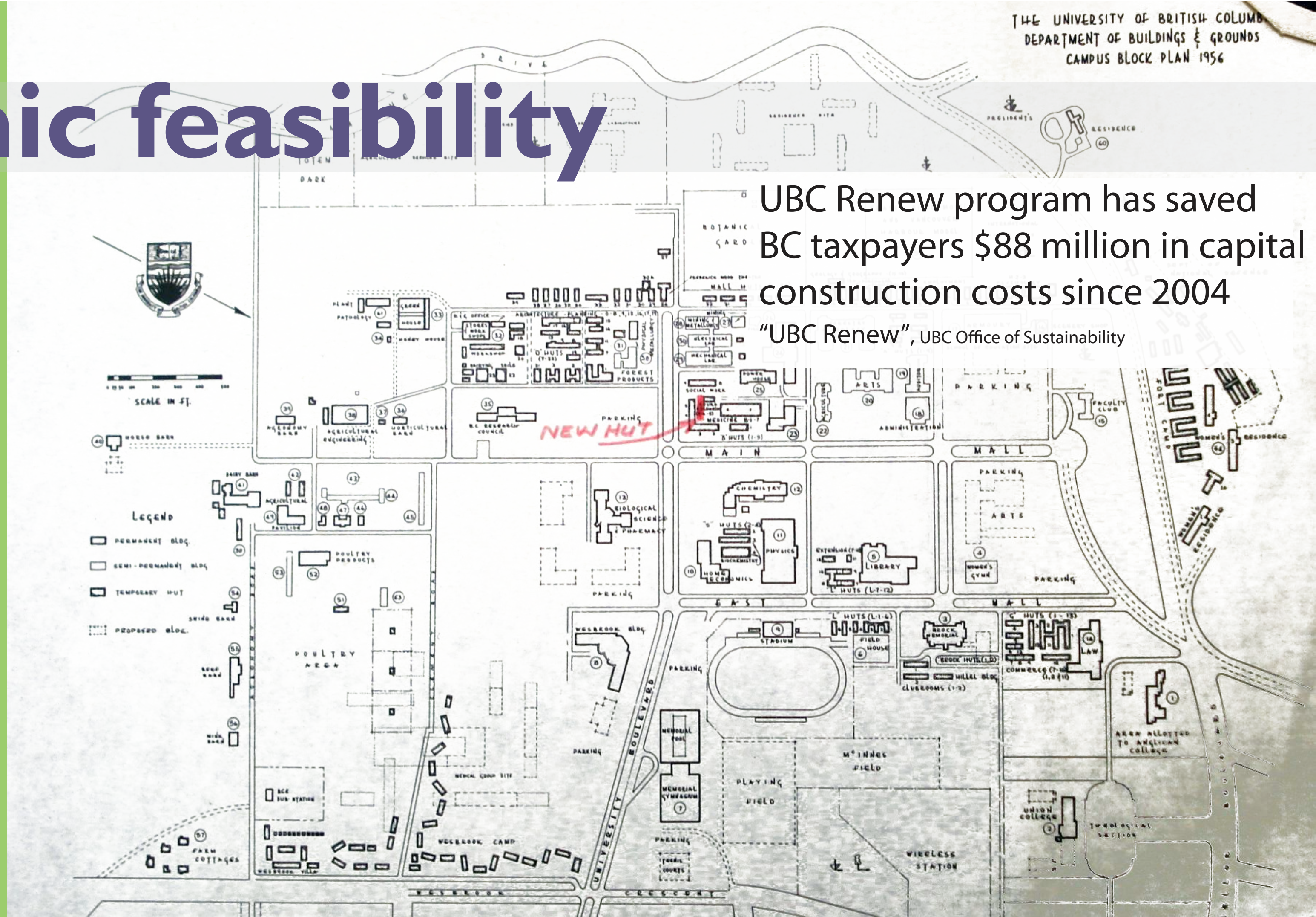
daylight break out room

glazed partitions in corridor

economic feasibility

UBC Renew is a highly effective means of addressing the need for new on-campus teaching and learning spaces while simultaneously retaining the heritage fabric of the campus community in an economically viable way. Given the fact that 60% of UBC buildings are thirty years of age or older, the UBC Renew program is designed to mitigate deferred maintenance concerns, increase the capabilities of existing space, and preserve campus culture by retaining heritage buildings.

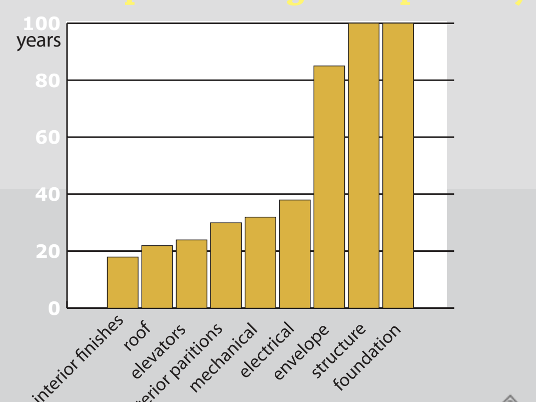
Started in 2005 in partnership with the Province of BC, phase one of the funding has been used to rehabilitate several buildings on campus, including the Friedman Building. Throughout the building boom of the post-war years through to the 1970s, capital renewal funding did not keep pace with maintenance requirements, leaving UBC with a legacy of buildings that did not meet fire and life safety requirements as well as spaces that were no longer suitable for contemporary research and teaching needs. This is known as 'deferred maintenance'. Public institutions often defer maintenance when faced with a demand for new space combined with limited budgets and funding cutbacks. At UBC, a building



UBC Renew program has saved BC taxpayers $88 million in capital construction costs since 2004

"UBC Renew", UBC Office of Sustainability

on-campus building life expectancy



deferred maintenance

Deffered maintenance is an accounting designation that indicates monies previously allocated to the maintenance of an asset were reallocated to reflect new budget or spending priorities.

Friedman Building cost analysis_2008

cost of building new:	$31.7 million
cost of rehabilitation:	$19 million
COST SAVINGS	$12.7 million

is considered for renewal if it can be rehabilitated to a like-new condition for two-thirds of the cost of a new building. The UBC renew program also targets LEED silver certification at a minimum for all Renew projects.

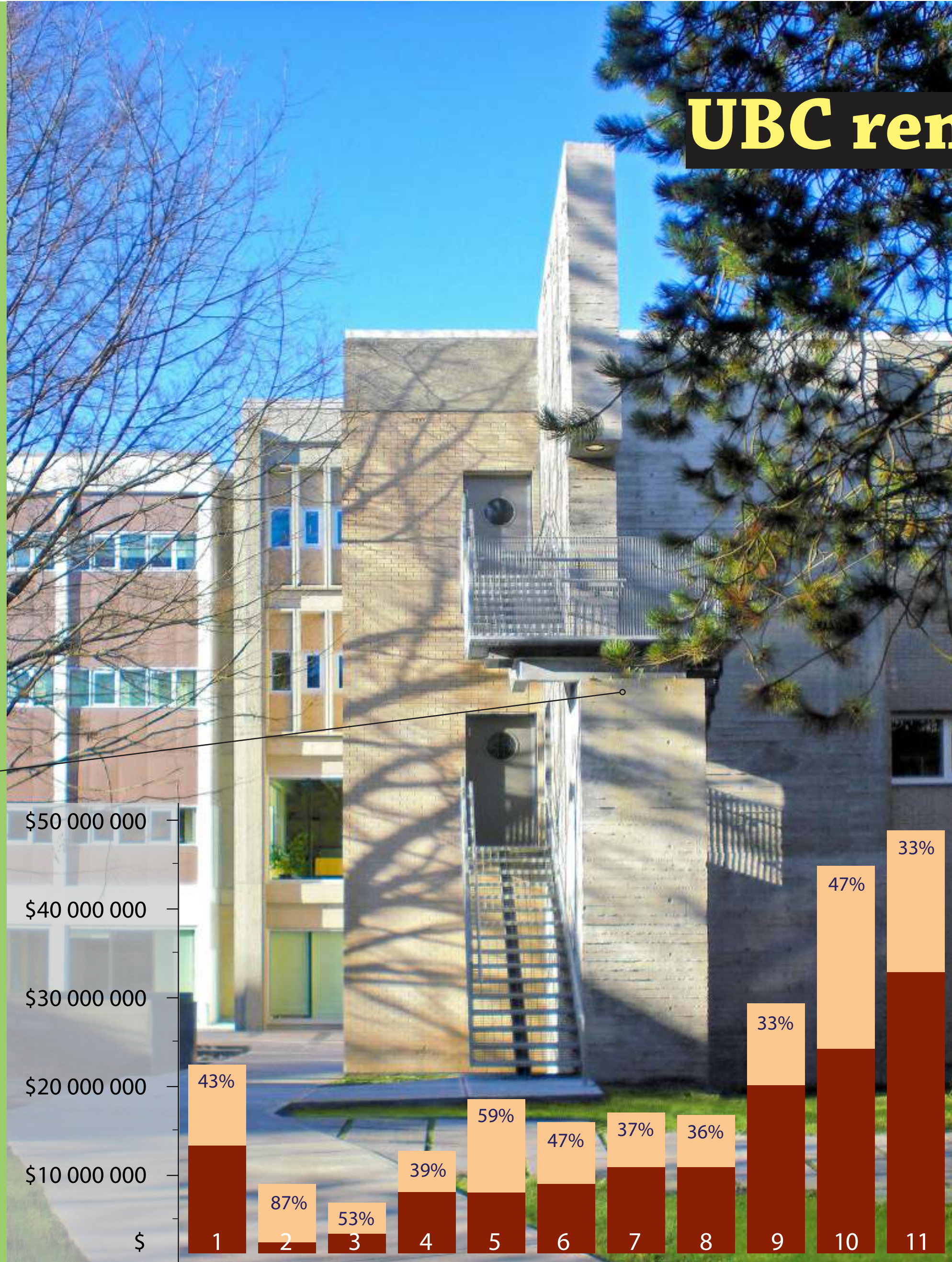
As with all older structures, current earthquake codes generally require extensive seismic upgrading. The cost of this can often dissuade owners from a rehabilitation of an existing structure in favour of simple demolish and re-built. Modernist buildings are no exception to this rule, although their concrete and steel construction is often more amenable to such upgrades. For the Friedman Building, seismic requirements offered a chance to showcase the renewal of the building in a highly visible way while paying homage to the architectural style of the original era.

Acton-Ostry introduced a buttress-like element to the south-east corner of the Friedman building in order to resolve concerns around lateral stability. However, rather than simply introduce a contemporary steel or concrete frame element to the building, Acton-Ostry sensitively inserted a rough, board-formed concrete buttress in the Brutalist style of the era. This not only becomes an exterior, visible sign of the updated building, but also serves as the new fire stair for the wing, again evocative of the transparent exterior fire stairs present in the original 1959 building.

UBC renew program

"UBC renew means for every two projects, you get three."

Mark Ostry, principal
Acton-Ostry Architecture



capital costs vs.
renewal costs

1. Average Cost + Savings
2. BC Binning Studio (1925)
3. Dorothy Somerset Studio (1925)
4. Buchannan Building C (1958)
5. Buchannan Building D (1960)
6. Buchannan Building A (1958)
7. Buchannan Building B (1958)
8. Chemistry Building North Wing (1961)
9. Friedman Building (1961/1967)
10. Auditorium Building
11. Chemistry Building (1923)

additional cost to replace with new

UBC Renew cost

how UBC selects a renew project

1. Is there a high demand for type of space?
2. Renewal cost must be less than two-thirds of replacement cost
3. Must meet Facility Condition Index criteria (current replacement cost vs. existing cost of deficiencies)

cost renewal considerations

Cyclical renewal
Deferred maintenance costs
Fire code & safety upgrade costs
Seismic upgrade costs
Hazardous materials abatement
Academic improvements
Site development costs
Dislocation costs
Historic value