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# GREEN INTERIORS

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photography by Martin Tessler

## INTRODUCTION

### *Our time is now*

*With increasing recognition of the impact of human activity on global climate change, there is now momentum and the will to employ the strategies imperative to reduce greenhouse gas emissions and other serious environmental impacts of buildings and interiors.*

### *Triple Bottom Line*

There is great opportunity to deepen the discipline of interior design, using a holistic approach described as the “triple bottom line.” This view balances the human, environmental, and economic dimensions of sustainability. Far from being competing agendas, they are interconnected and can actually reinforce each other. A successful solution that places equal importance on environmental stewardship, human well being, and economic profitability will reap many benefits. Many studies have shown that green design strategies, such as access to daylight and views and user-controllability of systems, contribute to the health and well being of the occupants. Sustainable design reduces greenhouse gas emissions, reduces energy and water consumption, uses resources more efficiently, produces less waste, and improves air quality.

Green features and human benefits both have positive economic benefits. The return on investment (ROI) for owners and tenants of leased properties is significant. Capital cost premiums for green buildings and interiors are recouped within reasonable payback periods with higher building performance and lower operating and maintenance costs. Optimizing systems such as lighting and HVAC may reduce capital costs. Other economic benefits include improved marketability, reduced liability risk, higher building value, productivity gains, and reduced employee turnover and absenteeism.

### *LEED® for Commercial Interiors*

Research and application of sustainable design is integral to every Penner & Associates project. In our practice, we have found LEED® for Commercial Interiors (LEED-CI) a rigorous tool for incorporating the “triple bottom line.” *The Leadership in Energy and Environmental Design (LEED) Green Building Rating System™ is the nationally accepted benchmark for the design, construction, and operation of high performance green buildings.*

With one project recently achieving LEED for Commercial Interiors Gold certification and four other projects targeting certification, Penner & Associates has extensive knowledge and experience in the implementation of LEED-CI and LEED for New Construction rating systems.

As LEED-CI focuses on tenant improvements of leased spaces in commercial and institutional buildings, it is of particular interest to interior designers. The US Green Building Council (USGBC) originally developed LEED-CI. The Canada Green Building Council (CaGBC) adapted and implemented LEED Canada-CI last year offering the reference package and letter templates in English and French. Both the USGBC and CaGBC offer LEED-CI Professional Accreditation exams. The LEED program has grown exponentially across the globe in the past few years, and increasingly governments, institutions, and other organizations are mandating it as the standard for their new buildings and interior fit-ups.

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Like the other LEED rating systems, LEED-CI is points-based with different levels of certification—Certified, Silver, Gold, and Platinum—depending on the number of points earned. Points are earned in each of six categories by meeting certain sustainable criteria. The categories are Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, and Innovation and Design Process.

To earn certification, a project must first meet prerequisite criteria:

#### Energy and Atmosphere (EA)

- EAp1 Fundamental Commissioning
- EAp2 Minimum Energy Performance
- EAp3 CFC Reduction in HVAC&R Equipment

#### Materials and Resources (MR)

- MRp1 Storage and Collection of Recyclables

#### Indoor Environmental Quality (EQ)

- EQp1 Minimum IAQ Performance
- EQp2 Environmental Tobacco Smoke Control

Further performance benchmarks or credits are awarded within each category, garnering points. The final tally of points earned determines the certification level:

- Certified 21–26 points
- Silver 27–31 points
- Gold 32–41 points
- Platinum 42–57 points

**FIGURE 1.** 7th Floor, Walter C. Koerner Library at UBC.



## CASE STUDIES

This article presents three green case studies including one project attempting LEED for Commercial Interiors certification.

### CASE STUDY 1: Canada Green Building Council, Vancouver BC

Client                Canada Green Building Council  
Project Type        Office  
Size                  750 square feet  
Completion         Fall 2006

The Canada Green Building Council (CaGBC) is a non-profit organization dedicated to promoting sustainable building practices. The intent behind the CaGBC's working office was to demonstrate green technologies to visitors through the office design, as well as to provide graphic display panels of other projects demonstrating sustainability. It was important to the CaGBC and the design team to target a

high level of LEED-CI certification. Other design criteria included optimizing limited space for a growing organization, and soliciting donations from manufacturers and suppliers wanting to showcase green materials, products, and technologies.

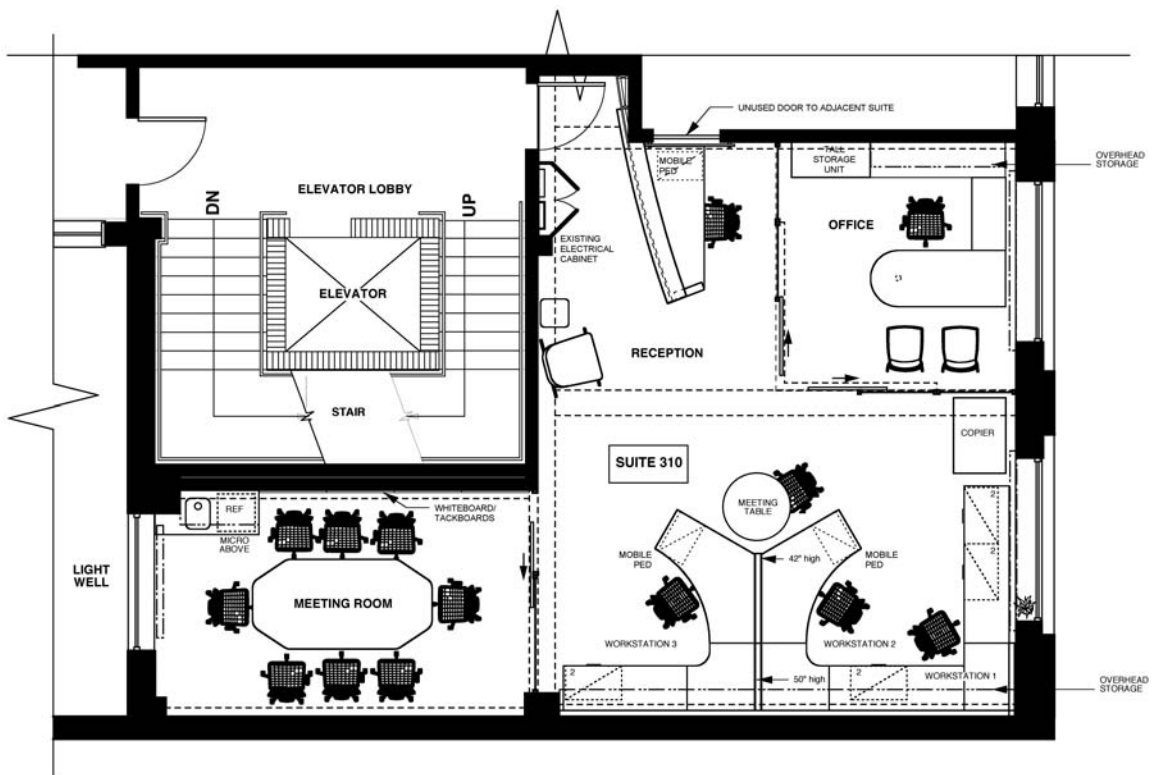
#### Functional Requirements

Work environment for five people, including:

- Reception
- Three open workstations
- One enclosed office
- One meeting room/beverage area

The design concept was to create a bright, light-filled office with a clean, modern aesthetic to complement the heritage character of the building. The natural beauty of materials was expressed in the exposed brick, solid Douglas fir millwork, steel, glass mosaic backsplash tile, hemp fiber countertop, and grasses laminated into clear resin. Awkward circulation cre-

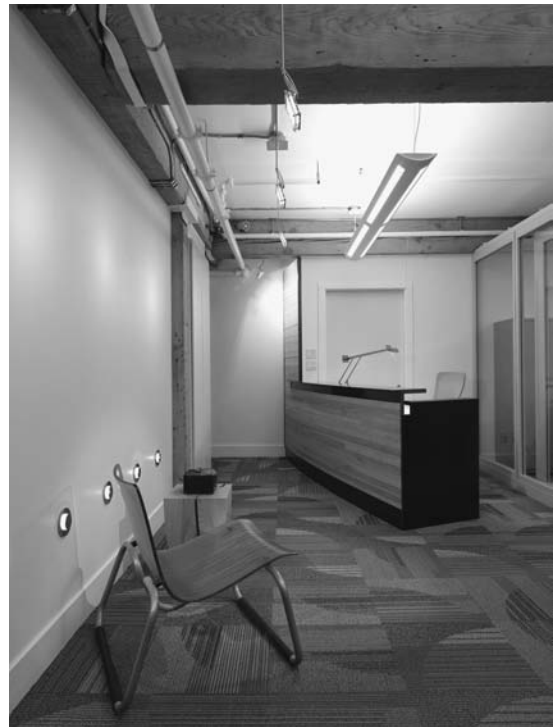
**FIGURE 2.** CaGBC floor plan.



**FIGURE 3.** Reception with view to office.



**FIGURE 4.** Reception.



ated by the constricted entry was improved by use of a curved wood wall that flows into the front of the reception desk, and widens into the space.

### ***Key Sustainable Features***

#### ***Sustainable Sites (SS)***

By selecting a tenant space within a heritage building in Vancouver's downtown core, development density and alternative transportation criteria were easily addressed.

The building is located within a quarter mile of five public bus lines usable by the CaGBC. Secure bicycle storage, with convenient changing/shower facilities is being provided for at least 5% of regular building occupants. No parking is guaranteed in the CaGBC's lease. Four LEED-CI points are being attempted.

#### ***Water Efficiency (WE)***

A low flow faucet aerator reduces water usage at the bar sink to 1.8 gallons per minute. As the bar sink and faucet were the only plumbing fixtures in the fit-

up, the design team felt it would be point chasing to attempt the Water Use Reduction credits.

#### ***Energy and Atmosphere (EA)***

Ambient light is provided by high-efficiency direct/indirect T5 fluorescent luminaires that provide glare-free, shadowless illumination. Fewer high-efficiency fixtures result in energy savings. Integrated occupancy and daylight sensors, with dimming ballasts on the fluorescent luminaires, conserve power, while dimming override provides user-control. An adjustable IRJC monopoint wallwasher grazes a textured wood wall and signage at the entry. Side-emitting LED wall lights backlit a resin chair. Innovative and energy-efficient, 12-LED-array adjustable monopoints highlight project photos on walls. LED undercabinet lights graze a mosaic backsplash, providing task lighting to the countertop. Lighting power density was reduced to 15% below the ANSI/ASHRAE/IESNA 90.1-2004 thus attempting one point for EA Credit 1.1 Optimize Energy Performance, Lighting Power.

With the exception of two laptops, eligible equipment and appliances are Energy Star-rated. High-reflectance colors help to maximize daylight, while PVC-free blinds, including blackout in the meeting room, control solar glare.

Five EA points are being attempted plus one point for exemplary performance related to EA Credit 4 Green Power. The CaGBC has purchased 100% of its electricity for a two-year period from renewable sources that meet the Green-e definition of renewable energy.

### ***Materials & Resources (MR)***

A broad range of environmental design strategies were employed, starting with the implementation of a Construction Waste Management Plan as per MR Credit 2. More than 75% of waste was diverted from the landfill.

Natural materials from rapidly renewable sources include wheat fiberboard core for the furniture, a countertop made with hemp fiber, pure wool upholstery fabric, and bio-based PLA fiber in the carpet

tile. The cherry veneer on the furniture and the fir millwork are Forest Stewardship Council-Certified. The carpet tile, wheat fiberboard, glass mosaic backsplash tile, systems furniture, seating, steel and gypsum board all have recycled content. The difficult-to-achieve MR Credit 6 Rapidly Renewable Materials and MR Credit 7 Certified Wood are being attempted. The limited budget was stretched by the donation of materials, products, and furnishings. Local suppliers eager to demonstrate certified wood use in our region, where a largely unsustainable forestry industry has a significant impact on the economy, donated FSC-certified Douglas fir.

**FIGURE 5.** Private office.



**FIGURE 6.** Open office workstations.



**FIGURE 7.** Open office area with view to Meeting Room.



**FIGURE 8.** Beverage bar in Meeting Room.



Eight MR points are being attempted plus one point for exemplary performance for MR Credit 6 Rapidly Renewable Materials. Building materials and products containing rapidly renewable content represent more than 10% of the total value of all building materials and products used in the project.

### ***Indoor Environmental Quality (EQ)***

As per EQ Credit 3.1, a Construction IAQ Management Plan was prepared and implemented during construction. Other strategies to optimize indoor air quality include the use of low-emitting adhesives and sealants; paints and finishes; composite wood and laminate adhesives with no added urea formaldehyde; and, PVC-free blinds. Furniture and seating are Greenguard Indoor Air Quality-certified.

Initially, the CaGBC requested that the open office area concrete floor remain exposed to demonstrate minimizing materials. During construction, the poor condition of the floor became evident, and car-

pet tile was installed to reduce dust and improve acoustics. The carpet system meets the Carpet and Rug Institute's Green Label Plus requirements for indoor air quality.

Workstations have user-controlled task lighting mounted under overhead storage, while the enclosed office uses computer software to control the ambient light levels. The layout affords complete access to daylight and seated views.

Eleven EQ points are being attempted.

In addition to the two exemplary performance points described above, three other points are being attempted in the Innovation and Design Process category.

### ***Collaborators***

CaGBC (client); Busby Perkins + Will, HCMA, Omicron, Penner & Associates and Stantec (LEED-CI documentation); Haworth (furniture sponsor); Ledalite (sponsor); MP Lighting (sponsor); reSource Rethinking Building (project manager); Wattstopper (sponsor).

## **CASE STUDY 2: CPR Arbutus Lands Information Centre, Vancouver BC**

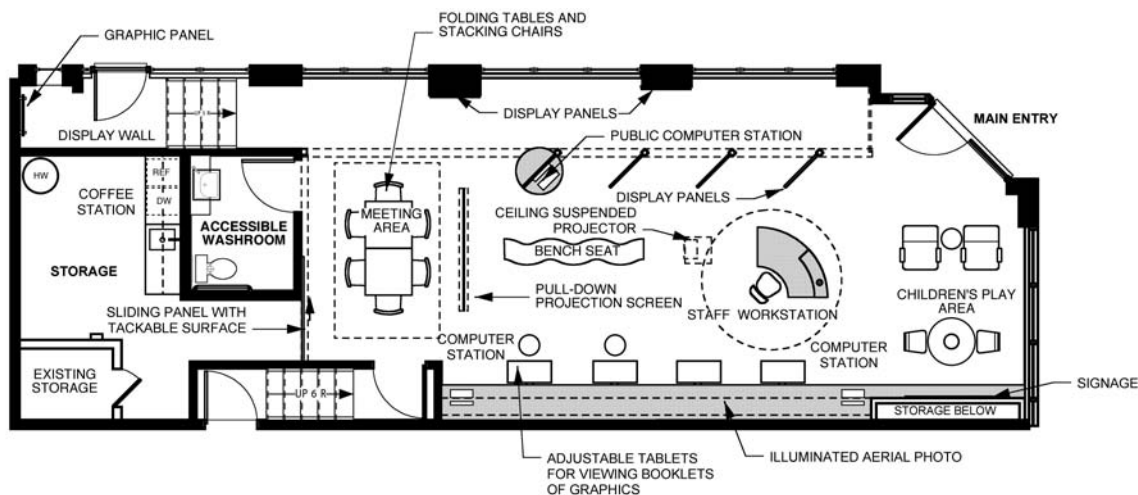
Client	Canadian Pacific Railways (CPR)
Project Type	Public information center
Size	1212 square feet
Completion	Summer 2006

The information center was built to invite and display public input into the future use of the Arbutus Corridor, an underutilized rail line. The client wanted the open, welcoming feel of a storefront community drop-in center, clearly expressing the transparency of the information-gathering process. One of the mandates for the design of the center was to reduce the environmental impact of the fit-up, so appropriate green strategies were determined and employed.

### ***Functional Requirements***

- Reception area for staff to greet and orient public
- Means of displaying graphics generated by public workshops
- Variety of seating allowing for range of public engagement
- Flexible meeting area

**FIGURE 9.** Arbutus Lands Info Centre floor plan.



One aspect of the design concept was to attract attention through the use of light and motion. An aerial photograph of the Arbutus Corridor was backlit, while projected images from the public brainstorming sessions cycled on a translucent screen. A comfortable environment was created with natural, sustainable materials and a warm color scheme and lighting. A multi-generational zone was provided with lounge seating, and children's furniture and toys. Accessibility was achieved through the use of user-adjustable tablets for sitting or standing and cantilevered display panels, maximizing openness at floor level. The use of repeated horizontal bands in the ceiling, floor pattern, and linear lighting created an allusion to the rail line throughout. Due to condensed design and construction phases and the short-term, one-year lease, LEED-CI certification was not attempted.

Adjustable low-voltage halogen accent lights mounted to display panels highlight the changing gallery of graphic displays generated from public input. Wood ceiling tiles with low voltage halogen recessed lights define the multi-generational zone.

Suspended T8 fluorescent luminaires provide uniform task lighting for the meeting table and for viewing the booklets of graphics. As the luminaire is not adjustable, tablets supporting graphic material are, to avoid veiling reflection. Flexible halogen track lighting provides light for the central multi-purpose area and rear wall display. Economical, concealed T8 fluo-

rescent luminaires, between suspended boards, define the path, allude to the rail line, create a rhythm of shadow and light bands on the floor and provide illumination over stairs. T8 fluorescent luminaires were also used to backlit the aerial photograph of the Arbutus Corridor.

Consistent 3000K color temperature and good color rendering index enhance the warm color scheme and graphics.

### **Key Sustainable Features**

#### ***Water Efficiency***

Water conservation measures included a 1.6/0.8 gallons per flush dual flush toilet and a low flow aerator on the lavatory faucet with a maximum flow rate of 1.8 gallons per minute.

#### ***Energy and Atmosphere***

Separate switching and incandescent dimmer controls maximize flexibility and control energy use. T8 fluorescent luminaires with a warm color temperature provide ambient light.

Both the refrigerator and dishwasher in the back area were Energy Star-rated, using 20% and 35% respectively less energy than US Federal Standards.

#### ***Materials and Resources***

Throughout most of the space, Tandus C&A Woolly carpet tile was used. This carpet tile was Scientific Cer-

**FIGURE 10.** Reception | linear map of Arbutus Corridor.



**FIGURE 11.** Cantilevered display panels and computer podium.



tification Systems-certified, containing 31% recycled content, with a minimum 7% from post-consumer recycled carpet. Tandus C&A has a carpet collection program in place to recover carpet at the end of its life and use it for the post-consumer content in its new carpet. The face fiber on the tile is 80% wool, a rapidly renewable material. The carpet system also meets the Carpet and Rug Institute's Green Label Plus requirements for indoor air quality.

The reception desk, counter, computer podium, and the core of the tack boards were all constructed from panels made out of wheat straw. The material is used as a substrate for veneers or laminates and, unlike most other substrates, contains no added urea

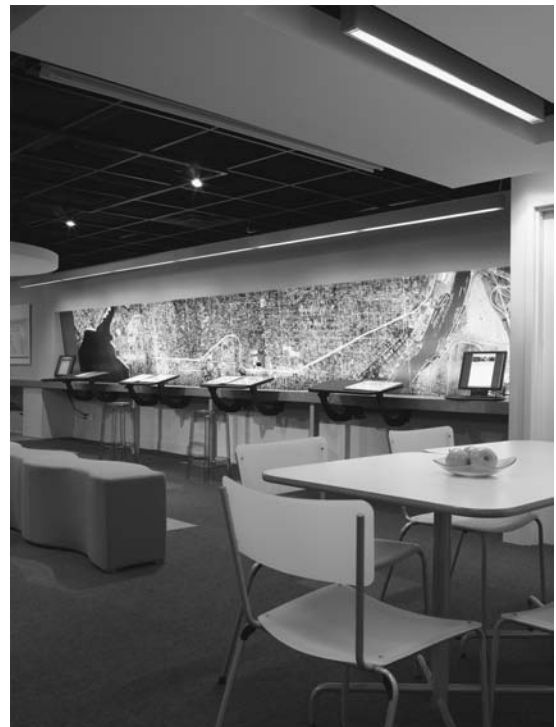
formaldehyde. The wheat fiberboard was finished with a beeswax finish. The painted cabinets and base were constructed from Medite II, a medium density fiberboard, which contains 100% pre-consumer recycled wood fiber and has no added urea formaldehyde.

The material on the face of the tack boards was a linoleum product made from natural, renewable materials: linseed oil, cork, rosin and jute. The flooring in the bathroom was cork tile, while in the back storage area, the flooring was retained from the previous tenant.

The adjustable tablets in front of the illuminated aerial photo were made from Richlite, a natural fiber composite. This material is a mixture of wood fiber cellulose from sustainably managed forests and phenolic resin. Richlite is manufactured in Tacoma, Washington. It is an inert material that does not off-gas.

Simply Wood, a local salvage company in the Lower Mainland of British Columbia, re-milled salvaged fir for the washroom vanity, the suspended ceiling boards and the column.

**FIGURE 12.** Meeting area | linear map of Arbutus Corridor.





**FIGURE 13.** Multi-generational zone.



PET lounge chairs from Steelcase were selected for the multi-generational zone. The material for the chair seats is made from post-consumer recycled plastic pop bottles. Every PET lounge chair has 25% recycled content and can use the equivalent of up to thirteen 16 oz. plastic bottles. The Steelcase Think chair at the front reception desk contains up to 41% recycled material. At the end of its useful life, it is up to 99% recyclable by weight, and may be disassembled in about five minutes using common hand tools. The PET chair is 100% recyclable. The Keilhauer Gym flip-top tables in the meeting area were manufactured in Canada and have a wheat fiberboard core. The Brayton Ripple bench is upholstered in a colorful pure wool felt.

Every effort was made to carry the green story through to the details. The Riverside Form glass plates and bowls were made from 100% post-industrial recycled glass. The Tom Dixon Eco Ware cups were made with bamboo fiber and biodegradable plastic. The cof-

**FIGURE 14.** Accessible display panels.



fee was organic and fair trade, while napkins and tissue paper had recycled content. Cleaning products were chosen for their reduced environmental impact. The vacuum cleaner included a HEPA filter to trap small particulate.

Recognizing the short-term character of the occupancy, consideration was given to the materials' end-of-use. Components were designed to be modular where possible, and were screwed rather than glued for ease of disassembly. The salvaged fir suspended ceiling boards were unfinished and installed so they may be taken down and salvaged yet again. The back-lit aerial photo was mounted to slip-in plexi-glass panels that could be easily removed and installed in another location. Rather than built-in millwork in the back area, pre-fabricated modular units were selected that could be taken out and reused.

This short-term lease also provided an opportunity to test materials and finishes that may have been too risky to implement for a longer-term occupancy.

At the project's completion, roughly 90% of the interior materials, appliances, light fixtures, and furnishings were salvaged and or donated to local community groups. The exterior landscaping remains as a gift to the community.

### ***Indoor Environmental Quality***

Low-VOC primers, paints, finishes, and adhesives were specified to reduce emissions and protect the indoor air quality. Both the PET lounge chair and Think chair are Greenguard Indoor Air Quality-certified. Many building materials contain VOCs (volatile organic compounds) that off-gas into the air during and after installation. The painter's substitution of higher-VOC paint for no-VOC paint specified, necessitated air cleaning prior to opening using negative pressure HEPA air filter with charcoal.

### ***Collaborators***

Canadian Pacific Railway (client); Colliers International Realty Advisors; Holland Barrs Planning Group; James Hoggan & Associates; Mona Construction; Retreat Garden Design; Wasserman & Partners Advertising.

## **CASE STUDY 3: University of British Columbia Instructional Resource Centre**

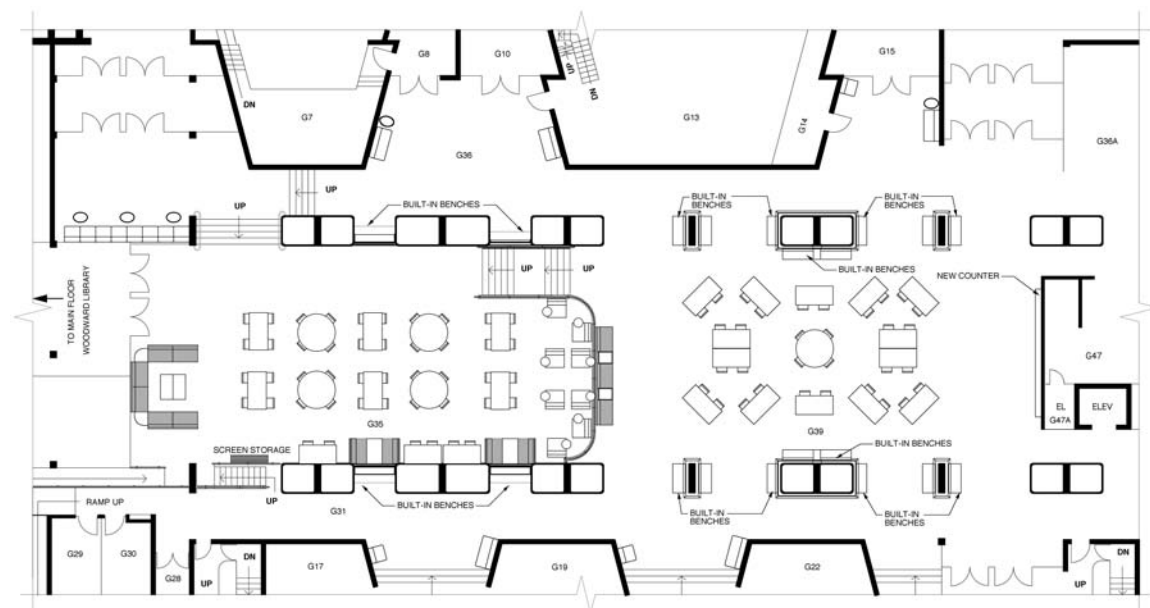
Client	University of British Columbia
Project Type	Lobby, study area, conference area
Size	10,000 square feet
Completion	Fall 2006

The Instructional Resource Centre (IRC) at the University of British Columbia is a multi-purpose space adjacent to a biomedical library that serves as a student study area and occasional conference location. LEED-CI certification was not sought due to budget constraints and a protracted schedule dictated by funding requirements.

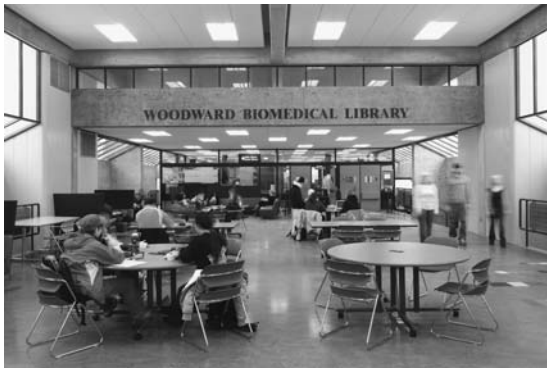
### ***Functional Requirements***

- Provide a flexible, open area to accommodate both individual and group study as well as information table set-up for conferences
- Add a variety of built-in and movable seating options
- Remedy existing problems of poor acoustics and inadequate light levels in the space
- Accommodate power requirements for laptops

**FIGURE 15.** UBC Instruction Resource Centre floor plan.



**FIGURE 16.** Upper Lobby.



**FIGURE 17.** Upper Lobby | entry to Woodward Biomedical Library.



To add seating options, the design incorporates cantilevered upholstered bench seating fixed to columns that flank the edges of the lower level. Power and data outlets are mounted within the panels. Built-in banquette style seating is set into a niche between the mechanical ducts lining the concrete sides of the raised area. A counter at the elevator core provides a surface for standing.

Flexible seating areas create a Learning Commons. Modular 2-seater Metro Bix upholstered benches have corner, coffee, and worktables. Units with high-upholstered back panels provide a sense of enclosure for group study and contain conversational noise. Metro Archipelago seating has an adjustable tablet arm for laptop use, and with a flexible layout so that

**FIGURE 18.** Lower Lobby.



**FIGURE 19.** Lower Lobby column.



individuals or pairs can use it. Existing lightweight stackable chairs and study tables were retained, and supplemented with new large circular tables with integrated power to allow for a range of study group sizes. Metro Bix modular sled-base lounge seating provides a touchdown area outside of classrooms for

students to gather before and after class. Studies have indicated that much learning happens in these areas as information received is discussed and digested.

The acoustic problems of the space are addressed by cladding the base of existing columns/mechanical ducts in FSC-certified acoustic paneling to a height of 6'-0". New acoustic tile is floated in the middle of the concrete ceiling coffers. The high-upholstered backs on the banquette seats provide comfort and acoustic absorbency. The back panels on the movable seating help to enclose sound. Infill panels, added to the existing metal pipe guard rails, create a buffer between the raised and lower areas.

The existing architectural color scheme features a concrete structure with cedar finish on the dropped ceilings, and brown quarry tile flooring in the lower area. Large vertical mechanical ducts are a bright yellow, and doors and graphics are in spectral hues of red and green. To work with the existing scheme, the design features neutrals with bright accents. New grey linoleum flooring is used throughout the upper level. Appropriate to its adjacency to the Woodward Bio-medical Library, bands of colored inserts are inspired

**FIGURE 20.** Lower Lobby built-in benches.



**FIGURE 21.** Lower Lobby | outside lecture hall 1.



by patterns seen in chromosome maps used in the research of the human genome. New furnishings feature bright red, blue, and green upholsteries offset against a neutral charcoal grey. The cantilevered bench seating features maple plywood shells stained in cedar tones with bright blue upholstered seat and back pad. The acoustic paneling is silver grey. The banquette seating is upholstered in neutral shades of grey with red and blue accents. The red countertop with stainless steel edge adds a color accent to the concrete wall.

### ***Key Sustainable Features***

#### ***Energy & Atmosphere***

High efficiency fluorescent luminaires were added to improve lighting distribution. The existing metal halide pendants, one centered in each coffer, were replaced with two more efficient linear fluorescent luminaires in each coffer for better light distribution. Linear fluorescent fixtures mounted vertically to the columns that bring light down to where it is needed replaced ineffective circular wall sconces mounted high on the concrete columns. A recessed fluorescent luminaire above the bench seating is integrated into the panels cladding the column to provide task lighting. High-reflectance ceiling tile added to high-bay concrete coffers creates a reflective ceiling plane that optimizes daylight from windows and skylights, and considerably brightens the general ambiance.

#### ***Materials and Resources***

Forest Stewardship Council-certified acoustic paneling was used to clad existing columns. Linoleum

**FIGURE 22.** Lower Lobby | outside lecture hall 4.



flooring, made from natural, renewable materials such as linseed oil and jute, was used in the raised area. The availability of a wide range of color options in the linoleum facilitated the design of multi-colored floor inserts.

Durability was a factor in material selection to maximize the useful life of a product. The upholstery on the built-in benches is Lytyn®/Polyester, a very durable alternative to vinyl. The banquette seats and the back panels of the lounge seating are upholstered in a 73% recycled content Nano-Tex™ fabric, a technology that gives the fabric inherently spill-repellent properties.

A countertop running across the back of the space has a hardwearing stainless steel edge.

### ***Indoor Environmental Quality***

Plywood with no added urea formaldehyde was used to infill an existing metal pipe guard rail. An interior layer of acoustic batt was sandwiched by two layers of perforated plywood, bonded by a low-VOC adhesive to create an acoustic buffer between the upper and

lower levels of the space. The new millwork's medium density fiberboard substrate also contains no added urea formaldehyde. All specified furniture is Green-guard Indoor Air Quality-certified.

### ***Collaborators***

College of Health Disciplines (client); Boldwing Continuum Architects; Equilibrium Consulting; Mc2; Omicron (electrical); Parkwood Construction; UBC Plant Operations–Project Services.

### ***CONCLUSION***

Interior designers specialize in balancing many different factors:

- Well-being of the occupants
- Business success of the stakeholders
- Budget and schedule constraints
- Durability and performance of materials and products
- The beauty expressed by materials, color, light, form, and volume
- The experiential quality of the space

Green strategies need to be integral to work in concert with the other parameters of a project, not applied afterthoughts. Within their purview, interior designers are especially qualified to help find the most appropriate strategies for a particular project.

Like any tool, LEED has its uses and limitations. Its value lies in establishing a framework and setting goals to reduce the environmental impact of the building industry, while providing quantifiable standards for measuring progress towards these goals. The risk is in simply point chasing, and ignoring other sustainable strategies that may not garner points.

One of the benefits of LEED is that it encourages an integrated design process in which relevant disciplines are engaged and contribute early on in the project. Hallmarks of an integrated design process, such as sustainable design charrettes and trade contractor orientation sessions, contribute to team-building and successful outcomes. By educating ourselves on green design and environmental issues, interior designers gain intellectual capital, which translates to adding value to our services, contributing to the integrated design process and team, and creating truly sustainable buildings. Our time is now!

## **ABOUT THE AUTHORS**

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Recognized as a leading green interiors firm in Canada, Penner & Associates has a reputation for high aesthetic standards and award-winning, innova-

tive design solutions. Their work extends to new construction and renovation of commercial, institutional, and residential projects.

Shelley Penner is a member of the LEED Canada-CI Core Committee. Penner & Associates is a member of the Canada Green Building Council and the US Green Building Council.