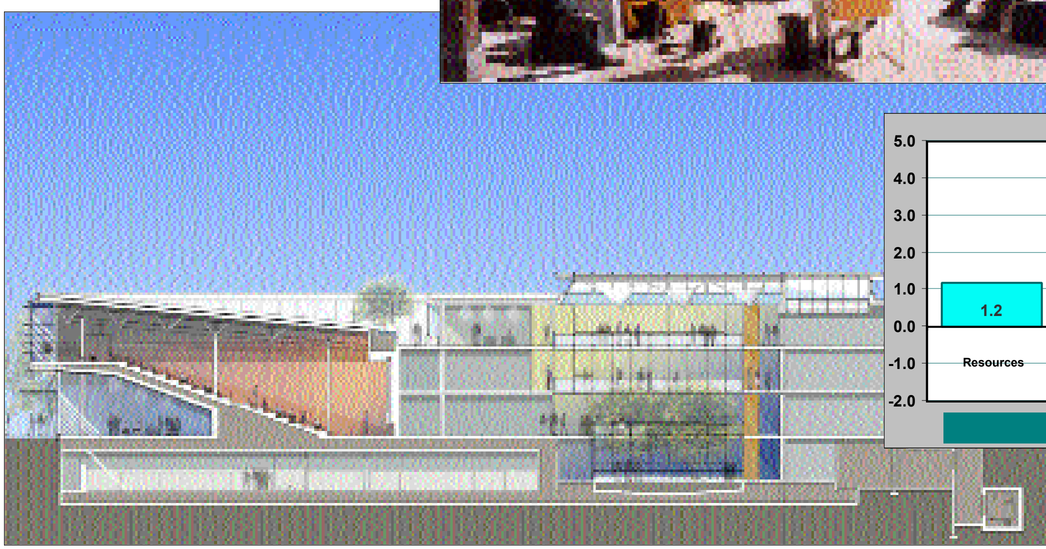
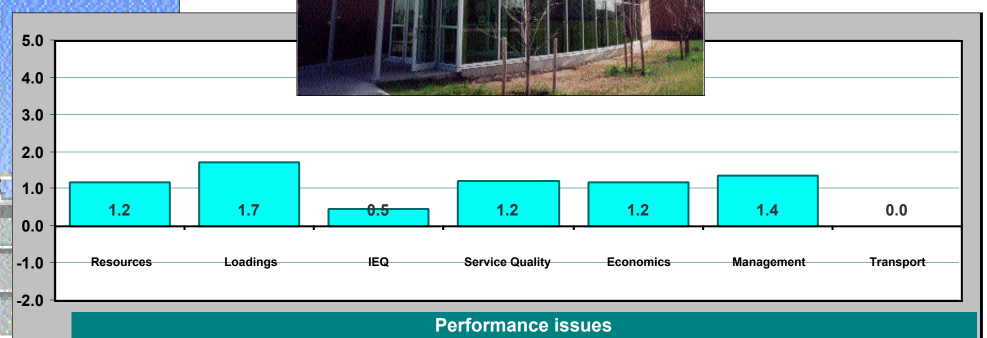
Green Building Challenge 2002 in Canada; An Overview

February, 2002





Background

The world at the beginning of the 21st century faces a number of serious and urgent environmental problems that must be overcome in order to transition society to sustainability. The design, construction and operation of buildings is one of the largest single contributors to the problem. For example, it has been estimated that the emission of Greenhouse Gas due to the construction and operation of all types of buildings is as much as 39% of all GHG emissions in Canada. Then there are other emissions, water consumption, use of scarce agricutural land, construction and demolition waste; and there are also indirect effects, such as the building's location having a major effect on the intensity of commuting transport.

The technology exists today to design and construct buildings with radically better environmental performance than the norm. Experience with advanced technology buildings through programs, such as Natural Resources Canada's C2000 Program and the Commercial Building Incentive Program, suggests that current standard new building construction energy performance can be exceeded by a least a factor of two without any increase in first costs. Considerable improvement in other aspects of environmental performance has also been proven.

There are a number of barriers to implementation of these technologies and design approaches. Two of the most significant barriers are not technological, but institutional:

- ❑ lack of understanding by the market of what is possible,
- ❑ propensity of designers and builders to rely on ingrained traditional practices.

Green Building Challenge (GBC) is an expanding international forum that challenges building stakeholders throughout the world to design, build and retrofit buildings in the most environmentally friendly and cost-effective manner. The first conference, GBC '98, which was initiated by Canada and held in Vancouver, BC, brought together teams from fourteen countries to present their buildings and technologies to the international community. The second conference, SB 2000, with nineteen countries registered, was held in October, 2000 in Maastricht, The Netherlands. The third conference, SB 2002, with twenty-one countries participating, will be held in Oslo, Norway in September of 2002.

The Green Building Challenge addresses barriers to improving building performance through:

- ❑ the continuing development of a universal building performance comparative evaluation methodology,
- ❑ the assessment, comparison and publicizing of real-world, best-practice buildings.

The GBC assessment framework has been produced in the form of software (GBTool) which facilitates a full description of the building and its performance, and also allows users to carry out the assessments relative to regional benchmarks. Participating national teams then test the assessment system on case study buildings in their own country.

GBC '98 and SB 2000 have significantly influenced awareness and practice in the past four years and SB 2002 will have a major long-term impact on the way that buildings are designed and constructed, both in Canada and elsewhere in the world.

In this next and third phase of work, the responsibility for managing the process will be taken over by a new non-profit organization, the *International Initiative for a Sustainable Built Environment,* or iiSBE . Canada will continue to support the central management and design functions, but each participating country is now expected to finance its own participation in meetings and for testing the system at home.

The Canadian GBC Team

The GBC-2002 Canadian Team (GBC-CT) has been formed to select, evaluate and present the best buildings being designed in Canada to an international forum at SB-2002. GBC-CT includes volunteers representing a broad cross-section of architects, engineers and other practitioners in the field from across Canada.

Support the Canadian GBC Team !

The Canadian Team has some financial support from Natural Resources Canada and Enbridge Consumers Gas, but the volunteer team urgently needs $90,000 so that this year's work can be completed. Helping us to achieve our goals will bring considerable publicity benefits to individual companies and to the Canadian industry as a whole. The Team is managed by the *Athena Institute for Sustainable Materials*.

Team Members include:

Alex Zimmerman, B.C. Buildings Corporation (Team Leader)
H. Robert Bach, Engineering Interface Limited
Marc Beaudoin, RCMP
Raymond Cole, University of British Columbia
Curt Hepting / Chris Jones, Enersys Analytics
Kevin Hydes, Keen Engineering Ltd.
Woytek Kujawski, Inpol Consultng
Nils Larsson, iiSBE/NRCan
Stephen Pope, Natural Resources Canada
Gord Shymko, G.F. Shymko & Associates Ltd.
Jiri Skopek, ECD Canada Ltd.
Wayne Trusty, Athena Institute for Sustainable Materials

Further information on GBC-2002, GBC-CT can be found at **<iisbe.org>**, and details of the SB 2002 Conference, to be held in Oslo during September 23-25, 2002, can be found at **<www.sb02.com>**. For information on C-2000, see **<www.buildingsgroup.net>** or **<iisbe.org>**.

Be a GBC Canada supporter !

Contact Alex Zimmerman at <azimmerman@bcbc.bc.ca> for details of benefits

GBTool Overview

The primary differences between the GBC framework and other environmental performance assessment systems include the following:

1. Existing systems such as LEED, BREEM etc. have been developed and implemented within the markets of a single country. The GBC framework and GBTool, on the other hand, are part of an international R&D process, and the system is therefore not intended for direct commercial application;

2. Whereas other main systems were each developed in a single country and remain primarily applicable to conditions in that country, the GBC framework has taken the approach that conditions vary considerably between countries, and even within countries. The GBTool software is therefore designed to allow easy identification of local factors and the insertion of region-specific values for benchmarks, weightings and standards;

3. The weightings of the two highest levels of parameters in GBTool can be adjusted by the user. This not only allows adjustment to local conditions as described above, but also permits users to exclude whole issue areas they consider to be non-applicable, or for which data are not available, such as Service Quality, Economics or Management;

4. The involvement of some 20 countries in the GBC process increases the likelihood that all major performance issues have been considered;

5. GBTool allows users to specify up to four user-defined occupancies in a project, and up to four different physical blocks. The software is thus suited to modern and complex buildings, unlike other systems that are limited to single building types;

6. GBTool covers a broad range of parameters, including issues not usually covered by other systems. The current assessment parameters included in GBC now include the following issue areas:

- ❑ Resource Consumption (non-renewable energy, land, water, materials)
- ❑ Environmental Loadings (greenhouse gas emissions, air pollution, ozone depletion, solid waste, liquid waste, effects on adjacent properties)
- ❑ Indoor Environmental Quality (air quality, thermal comfort, daylighting, lighting, acoustics,)
- ❑ Service Quality (adaptability, maintainability)
- ❑ Economics (life-cycle emphasis)
- ❑ Management (staff training, tenant performance incentives etc.)
- ❑ Transportation (related commuting transport- not yet operational)

Projects Selected for Assessment in GBC2002

Mayo School, Mayo Yukon

Overview

The Mayo School is a new K-12 school and community campus facility with a floor area of 3,300 m^2, located in the Village of Mayo, Yukon Territory, northern Canada (Lat. 63º 34' N, 135º 52' W)

The Mayo School project team included the following:

Owner:	Yukon Territory Government & Dep't of Education
Architect:	Kobayashi + Zedda Design Group, Whitehorse
Structural:	Fast & Epp Partners, Vancouver
Mechanical:	Northern Climate Engineering, Whitehorse
Electrical:	Dorward Engineering Services Ltd., Whitehorse
Landscaping:	Inukshuk Planning and Development
C-2000 facilitation:	G.F. Shymko & Associates, Calgary
Energy engineering:	G.F. Shymko & Associates, Calgary

Assessment team:
Stephen Pope, NRCan (team leader), Robert Bach, Engineering Interface Limited; Energy analysis: Chris Jones/ Curt Hepting, ENERSYS; Jamie Meil, Athena Sustainable Materials Institute, Embodied energy analysis.

Description

The school has received the maximum grant allowable under the Natural Resources Canada (NRCan) Commercial Buildings Incentive Program in recognition of energy efficient design. It also conforms to the requirements of the NRCan C-2000 Program for Advanced Commercial Buildings demonstrating low energy consumption, low water consumption, and good indoor environmental quality, assessed at the completion of design. The school is currently completing construction.

In addition to good building performance the Mayo School demonstrates a strong community integration. It provides separate teaching spaces for elementary and high school level students, and serves as a community and recreation centre, library, and disaster relief centre for a largely First Nations community. It replaces a previous school assembled out of trailers.

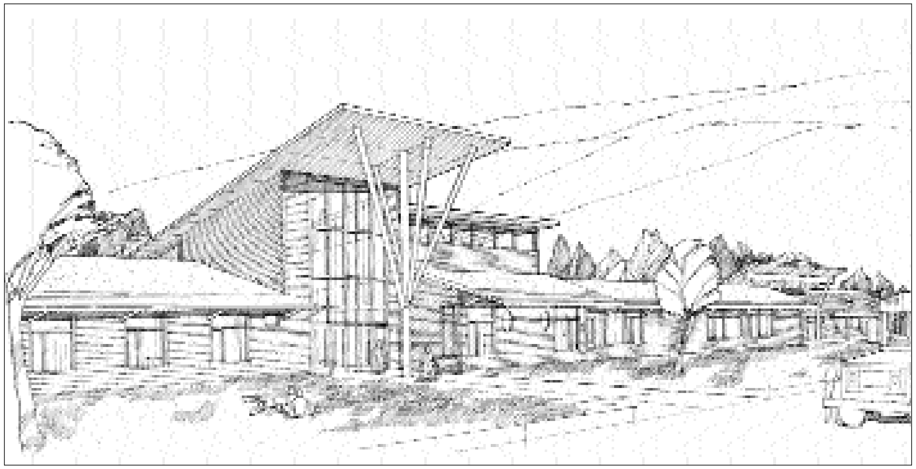
The project presents a strong combination of "best practices" design and construction detailing plus a significant community integration. The attention to the benefits of local labour and the multiple programmed use of the facility address the social impacts and benefits that take the project from good operational performance to the broader scope of community sustainability.

Through the participation in the C-2000 program, the project also demonstrated the successful use of integrated design, a design method that delivers better environmental performance by reworking the relationships between the various disciplines on the design team and their respective relationship to the client. Another benefit of this approach is the addition of operations energy simulation as a support for design decisions while the design process is ongoing.

The school is built using wood frame technology that is familiar to local construction teams, allowing the completion of the project without the require-

Mayo School, Mayo Yukon

ment of importing specialty labour crews from the south. Engineered wood products are used throughout the facility eliminating any need for old growth structural lumber, and making efficient use of materials. A summary of the efficiency measures follows:



- ❑ Siting – in keeping with the community focus of the facility, the main entrance is aligned with the main street and forms its terminus;
- ❑ Passive Solar – east/west orientation of the long axis of the school maximizes the passive solar potential;
- ❑ Insulation – Nominal R28 (RSI 4.93) walls and R60 (RSI 10.57) ceilings;
- ❑ Windows – aluminum and vinyl framed windows using spectrally selective soft-coat low-e films were used. Large overhangs and sun screens control summer sun and heat gain while allowing low angle sun in shoulder seasons;
- ❑ Daylighting – extensive use of natural light reduces need for artificial illumination;
- ❑ Lighting – T8 fluorescent lamps with DDC controls including daylight sensors and occupancy sensors. Fluorescent high bay lamps also used in Gymnasium;
- ❑ Ventilation – 100% outdoor air delivered to fan coils in teaching areas. Controls on the ventilation system provide the ability to bring fresh air only to classrooms that are in use. Operable windows on opposite faces of classrooms provide the potential for natural ventilation. Indoor air quality is addressed at source with use of low VOC latex paints and a majority of floor and wall finishes in linoleum and wood. Little carpet is used.
- ❑ Heating – both heating and cooling are provided by fan coils in the crawl space feeding full room width distribution cabinets. Return air is taken at a high level in the room and ducted down the walls;
- ❑ Ground water cooling – chilled water for cooling coils is taken from available ground water, reducing system complexity and maintenance.

Projects Selected for Assessment in GBC2002

Jackson-Triggs Winery, Niagara-on-the-Lake

Overview

The Jackson-Triggs Winery is a winery production and retail facility in Niagara-on-the-Lake, Ontario, Canada. The two-storey structure contains approximately 4,000 m^2, and was completed in July, 2001.

Owner: Vincor International

Architects: Kuwabara Payne McKenna Blumberg Architects

Structural: Blackwell Engineering

Mechanical: Keen Engineering

Electrical: Carinci Burt Rogers

Landscape: Janet Rosenberg & Associates

Lighting: Suzanne Powadiuk Design

Contractor: Merit Contractors of Niagara

Assessment Team:

Jiri Skopek (team leader); Nils Larsson, NRCan, Gord Shymko, G.F. Shymko & Associates, Energy analysis; Jamie Meil, Athena Sustainable Materials Institute, Embodied energy analysis.

Description

The designers of the 4,000 m^2 Jackson Triggs Winery were given three environmental objectives:

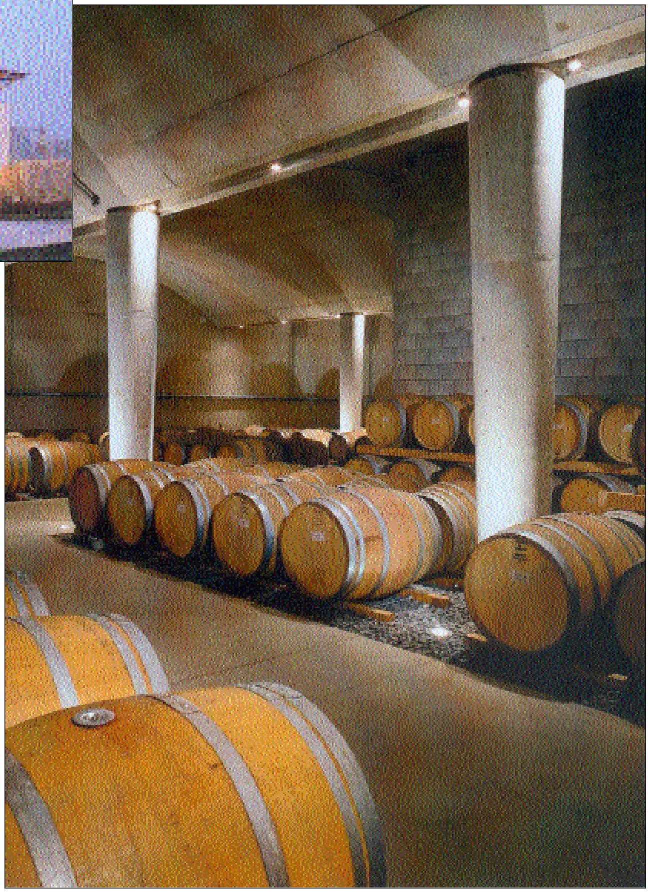
- The building should be agrarian in nature.
- Building systems should be just as conservationist as the winemaking process.
- Emission of CO_2 are to be minimized

A design charette was used to weigh green design versus business issues and to integrate the design process. The charette was attended by the Project Architects, Design Consultants and the Owner.

The winery is divided into two principal components. The public space is located at the eastern end of the building and includes the tasting areas, a retail shop, and entertaining and administration areas. The western half houses the fermentation tanks as well as storage and barrel cellars, all of which are accessible to the public as part of the winery tour. The large, double height Great Hall acts as both the link and the buffer between public and production areas.

The Great Hall is just one of several features used to address environmental issues. The production spaces are organized to use gravity flow in the wine-making process, and storage spaces are located in the cave-like

Jackson-Triggs Winery, Niagara-on-the-Lake



Illustrations

Above: Sketch of the South elevation

Right: The wine storage area

basement, where the heat sink effect of the surrounding earth maintains a stable, cool and humid environment.

A number of the environmental and mechanical features include:

- An on-site storm water collection system discharges to "soak away" pits.
- An East/West building orientation and five to one floor plate ratio, maximizing south facing passive solar gain.
- Daylighting is maximized to reduce reliance on artificial illumination systems-reduces cooling loads and costs.
- A 5 m roof overhang on the south-west and east faces minimizes direct solar heat gain and reduces the cooling energy requirements.
- Natural ventilation is maximized in all areas through the use of operable windows during shoulder (Spring and Fall) seasons to reduce the reliance on building heating and cooling systems.
- A displacement ventilation system is used for office, boardroom and lounge areas where high ceilings allows stratification, subsequent energy reductions and improvement in indoor air quality.
- Air to air heat exchangers are used for pre-heating of fresh air for the building.
- A radiant floor heating system uses concrete mass for storage and a thermal flywheel effect.

Projects Selected for Assessment in GBC2002

Red River College, Winnipeg, Manitoba

Overview

The project is a large educational facility in downtown Winnipeg, Manitoba. It includes extensive renovation of existing facades and new construction inserted behind. The total project will contain 20,500 m^2 in buldings that range from one to five storeys, and will be completed in 2003.

- ❑ Owner: Princess Street Consortium Inc.
- ❑ Client: Manitoba Government Services and Red River College
- ❑ Project Manager, Accomodations, Development Division, Manitoba Gov't Services.
- ❑ The consortium is comprised of the following companies: Ada Holding Co. Ltd., A. Akman & Son(1991) Ltd., Corbett Cibinel Architects and J.J. Barnicke Winnipeg.
- ❑ Architect: Doug Corbett, Corbett Cibinel Architects, Winnipeg, Manitoba
- ❑ Assessment Team:

  Woytek Kujawski, INPOL Consulting (team leader), Alex Zimmerman, BCBC; Energy analysis: Chris Jones/ Curt Hepting, ENERSYS; Embodied energy analysis: Jamie Meil, Athena Sustainable Materials Institute

Above: Work underway, as of January, 2002

Description

This project is a $31.5 million satellite campus for Red River College in Downtown Winnipeg. It will be home to approximately 2000 students and 200 staff involved in media and information technology programs. The Princess Street Campus is not only is the first C-2000 project in Manitoba, it also the largest and most complex C-2000 project yet undertaken in Canada. The project includes three phases that will be linked by a central atrium: Phase One involves the reuse of an existing early 1900's warehouse building with an annex added; Phase Two will incorporate a row of historic facades of some of the oldest buildings in Winnipeg; and Phase Three will be an entirely new building. Construction is underway with Phase One scheduled to open in September 2002.

Several features are of environmental interest:

- ❑ Site development - The site was previously almost 100% buildings and hard surfaces. The new project will be similar but with a green roof and some new landscaping to mitigate habitat, groundwater and micro-climate effects. The new building profiles will be similar to the old with

Red River College

regard to shading and view obstruction of neighbours to the north and east. There will be some additional shading to the west.

- Water consumption - The campus will be fitted with water-conserving fixtures and controls. The vegetated roof will be irrigated exclusively with precipitation once established.

- Re-use of existing structures and materials - Phase One is primarily an adaptation of a 4600 m^2 existing bldg. with a new roof and an addition. Subsequent phases will incorporate the reconstructed heritage facades along Princess Street. All heritage millwork suitable/or salvageable was removed for reuse, as were some windows and doors and interior tile and glass. A high rate of brick and stone recovery for reuse from demolition was achieved through hand methods. Timber trusses, cast-iron columns and reusable lumber were salvaged as well as many other miscellaneous items. Records have been kept of materials recovered.

- Use of local and recycled materials - Purchasing from local and Canadian sources has been emphasized where possible, using Manitoba's Sustainable Development Procurement Guidelines. Further recycled content and low embodied energy and pollution sources are being researched. Records of materials specified and purchased are being kept for assessment.

Above: Street level entry

- Emissions of Greenhouse Gases - The aggressive energy consumption targets demanded by the C-2000 program ensure reduced environmental loading from operating energy. Building materials have been selected with low effective environmental loading as a criterion.

- Emissions of ozone-depleting substances - Major refrigeration compressors employ 134A refrigerant. Smaller units use the lowest ozone depletion rated commercially-available refrigerant. Non-HCFC rigid insulation materials are being researched.

- Emission leading to acidification from building operations - This is expected to be minimal. Natural gas flue venting from condensing-efficiency burners will be the only emissions.

- Construction and demolition wastes - The contractor has initiated a site waste recovery program. Demolition waste records are available for buildings removed and for pending construction.

- Indoor air quality - The HVAC design has a high ventilation effectiveness and excellent air distribution. Operable windows will be used throughout to promote natural ventilation during appropriate conditions. Dedicated exhausts are provided in equipment areas where pollutants may develop. Low toxicity interior materials will be emphasized to reduce pollutant loads.

- Thermal comfort - Solar control to reduce overheating is achieved by spectrally-selective glazing and window and shading device design. The high performance glazing also mitigates winter radiant heat loss from occupants, eliminating the need for perimeter radiation in most glazed areas. A four-pipe fan coil HVAC system provides tight zoning as well as exceptionally stable temperature control.

- Daylighting - Daylight design for instructional and office areas and common areas has been given a strong emphasis, including an unconditioned atrium circulation spine. Spectrally selective glazing admits 71% of visible light and is tuned by exposure and visual and thermal comfort needs.

- Adaptability and flexibility - The steel frame new structure is as adaptive as possible for this size and occupancy compared to concrete and masonry. Relatively lightweight and independent interior construction

Red River College

methods are used. Flexibility is achieved through planning for various instructional methods in the same spaces thereby reducing need for renovations. The fan coil HVAC systems are modular in nature, as are the suspended lighting systems used in most areas.

- ❑ Controllability of systems - Operable windows are used in key locations. Occupancy sensors will control ventilation and lighting. Daylight sensors will be used in strategic locations where energy benefits can be expected.
- ❑ Maintenance of performance - The facility will be leased by the development consortium to the College, with the consortium assuming financial and functional responsibility for operation and maintenance. This will promote ongoing sustainability of performance. Manitoba Hydro has also indicated interest in doing post occupancy evaluation to monitor performance.
- ❑ Privacy and access to sunlight and views - Sunlight control is the main design concern for instructional spaces. Views of Winnipeg and the downtown heritage exchange area are provided from all elevations.

Illustrations

Below: Aerial view from the South

Right: The Atrium, facing North