Winnipeg Mountain Equipment Co-op

Sustainable Building Design Case Study

299 Portage Ave., Winnipeg, MB.

Submitted for Partial Credit in:

Architecture 366

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1. INTRODUCTION

The Winnipeg Mountain Equipment Co-op (MEC) designed by Prairie Architects, Inc., is a green project that incorporates many sustainable concepts. These include passive design, green roof technology, photovoltaic panels, and composting toilets. Other sustainable concepts have also been integrated into the construction, such as the use of recycled materials. The building has been honoured by the Canadian Council of Ministers of the Environment (CCME) for its application of sustainable building techniques and technologies (CCME, 2003). It is one of the first Canadian retail buildings to meet the C2000 Green Building Standard, second only to MEC's Ottawa location (CCME, 2003).

The 2001 LEED criteria system, developed by the U.S. Green Building Council, is referred to throughout this report to evaluate and quantify the sustainability of the building. The LEED program focuses on five areas of design: *Sustainable Sites*, *Water Efficiency*, *Energy and Atmosphere Impacts*, *Mineral and Resource Use*, and *Indoor Environmental Quality*. MEC is eligible to achieve credits in each of these categories. Additional credits are available for exceptional performance in the Innovation and Design category.

These categories and MEC's eligibility to allocate these points are described in the following sections. The building is eligible to earn 55 out of a possible 69 points, a Platinum rating. The corresponding LEED checklist is attached in Appendix A. Upon completion of the green roof, MEC hopes to register their Winnipeg building with the Canadian Green Building Council once it is established.

It should be noted that because this building was only recently constructed and it is considered unfinished pending the establishment of the green roof, very few references were available, particularly published references. Therefore, the authors relied heavily on personal communication with Prairie Architects and with Lisa Duek, the Environmental Coordinator at MEC Winnipeg.

2. SUSTAINABLE SITES

Sustainable Sites allows for a possible 14 LEED points in eight categories. The MEC building is eligible for 9 of these points, as discussed in the following sections.

2.1. Prerequisite: Erosion & Sedimentation Control

The first LEED prerequisite is to meet local standards and codes that outline erosion control or EPA Best Management Practices (US Green Building Council, 2002). The MEC building in Winnipeg meets this requirement and is therefore eligible for credits in the "Sustainable Sites" category.

2.2. Site Selection

The LEED requirements state that buildings and parking areas cannot be developed on areas of special concern, such as prime farmland, endangered species habitat, or floodplains. The purpose of these criteria is to reduce the environmental impact by developing only on appropriate sites. Meeting these criteria is worth one point on the LEED evaluation. (US Green Building Council, 2002)

The site chosen by MEC for their Winnipeg retail store fits all of the LEED requirements, making it eligible for one LEED credit. In addition, it is a site that was previously developed and had been for decades (Prairie Architects, 2002), meaning that there was little risk of negative environmental impact. The utilization of a developed site is generally considered to be an environmentally beneficial decision because it may reduce pollution due to construction and avoid contributing to urban sprawl.

2.3. Development Density

Development density refers to the promotion of urban redevelopment in order to increase urban density, thereby utilizing existing infrastructure while protecting greenfields, natural resources, and wildlife habitats. The density goal is 60,000 square feet per acre –

approximately equivalent to a two story downtown development. (US Green Building Council, 2001)

The Winnipeg MEC building exceeds this goal by attaining a total development density greater than 95,000 square feet per acre – approximately 2 ½ stories. The average urban density surrounding the building is 250,000 square feet per acre – about 8 stories per acre. (Prairie Architects, 2002) This is worth one point in the LEED evaluation.

2.4. Brownfield Redevelopment

Brownfield redevelopment pertains to the utilization of a site that has real or perceived environmental contamination, and therefore may involve complex development issues. The use of such sites lends itself to urban revitalization and reduces urban sprawl. (US Green Building Council, 2002). Although the Winnipeg MEC building was constructed on a previously developed site, there is no indication that this site was contaminated or considered a Brownfield site; therefore, MEC would not be eligible for the point.

2.5. Alternative Transportation

The location of a building can encourage or discourage use of alternative public transportation, thus reducing pollution from automobile use. The LEED rating system provides one credit if buildings are located near suitable public transportation. A second credit is given if there are appropriate means for securing bicycles, and provision of changerooms and shower facilities for building occupants who are cyclists. A third LEED point is given for the installation of alternative-fuel refuelling stations in separately ventilated areas or outdoors. The final point in this category is given if the parking capacity does not exceed the minimum local zoning requirements or does not increase the parking capacity of rehabilitated sites, with preferred parking for carpools. (US Green Building Council, 2002)

MEC as a company is known for actively encouraging alternative transportation and the Winnipeg location was developed without including public parking. The building is

located near 45 bus routes. Situated outside of the building are 20 public bike racks, with 30 additional racks provided inside for employees. Shower facilities are also provided for employees. (Prairie Architects, 2002) MEC is therefore eligible for three of the four LEED points in this subcategory.

2.6. Reduced Site Disturbance

Development can greatly disturb the natural state of an area; this can be reduced through the conservation of natural areas and the restoration of damaged ecosystems during construction, thereby providing a habitat for plants and animals (US Green Building Council, 2002).

Since the Winnpeg MEC building was constructed on a previously developed site, the relevant LEED requirements (worth one credit each) are that a minimum of 50% of the remaining open area is restored using native or adapted vegetation, and that the development footprint, which includes the building, access roads, and parking, is reduced to exceed the local zoning's open space requirement for the site by 25% (US Green Building Council, 2002). Although a green roof was constructed as part of the building design, thereby incorporating native plants and reducing the ecological footprint of the project, MEC does not meet the requirements for these two LEED points (Prairie Architects, 2002).

2.7. Stormwater Management

The purpose of stormwater management is to reduce the amount of run-off from the site by increasing on-site infiltration, thereby limiting the disruption of natural water flow. LEED also emphasizes the reduction of on-site contaminants in order to eliminate potential impacts associated with contaminated run-off. (US Green Building Council, 2002)

The green roof on the MEC building adsorbs more than 25% of all the rainfall that hits the site. The rain that falls on the rest of the roof is collected in basement storage tanks

and pumped through an irrigation system servicing the green roof. This design makes MEC eligible for both LEED points. (Prairie Architects, 2002)

2.8. Heat Island Effect – Roof and Non-roof

Heat island effect refers to the "thermal gradient differences between developed an undeveloped land" (US Green Building Council, 2002), due mostly to the thermal storage capacity of concrete. Reducing this heat effect is important in order to minimize the impact on humans and wildlife habitat within the area. (US Green Building Council, 2002)

The LEED system provides a one point each for heat island mitigation techniques pertaining to roof surfaces and non-roof surfaces. The non-roof surfaces must be subject to one or more of the following design techniques: provide shade, use high-albedo materials, use open grid pavement, and underground or structured parking. The roof surfaces must be subject to one of the following design techniques: use of high-reflectance, high emissivity roofing (also considering aged reflectance), or a vegetated roof. (US Green Building Council, 2002)

The green roof covering 25% of the MEC building's roof significantly reduces the urban heat island effect at the site. The remaining portion of the roof was constructed using a highly reflective material, thus significantly reducing adsorption of solar heat. Three awnings constructed from metal provide shade over the front plaza. The building is thus eligible for both LEED points. (Prairie Architects, 2002)

2.9. Light Pollution Reduction

The LEED system provides one point for the elimination of light trespassing from the building and site, thereby improving visibility of the night sky and reducing the impacts of development on natural environments and nocturnal species (US Green Building Council, 2002). The MEC building has been designed with curved metal awnings that result in an indirect and subtle site lighting scheme. The light is focussed on the public

areas of the site, reducing the light emitted into the night sky. However, the building does not meet the exact requirements for this LEED credit. (Prairie Architects, 2002)

3. WATER EFFICIENCY

Water Efficiency allows for 5 possible points on the LEED checklist. MEC is eligible for all 5 points, as discussed in the following sections.

3.1. Water Efficient Landscaping

Under water efficient landscaping, the LEED system encourages limiting or eliminating the use of potable water for landscape irrigation. The LEED system also encourages a reduction in volume of storm water discharged from the site and an improvement in water quality. The MEC building is considered a world leader in green design based on its storm water management techniques. The building uses a green roof to absorb falling rain, which effectively absorbs 25% of the rainfall on site (Prairie Architects Inc., 2002).

Rain is collected in a series of storage tanks in the basement, then pumped using power from photovoltaic panels, to the roof's irrigation system. Storm water is used for all MEC's irrigation needs. In the summer, the water is evaporated from the roof to provide approximately 40 million BTU's of cooling (Prairie Architects Inc., 2002). Additionally, native and drought-resistant plants (prairie grasses) are planted on the green roof.

One credit is provided for the capture and use of rain water for irrigation. Another credit is issued for the use of highly efficient irrigation technology for a total of two credits for this section.

3.2. Innovative Wastewater Technologies

The LEED system encourages reducing the generation of wastewater and potable water demand, while increasing the local aquifer recharge. MEC incorporates two composting toilets and composting toilet policies to effectively reduce the volume of wastewater by

more than 50% or 21,312 gallons per year (Prairie Architects Inc., 2002). This earns MEC one LEED credit point.

3.3. Water Use Reduction

LEED encourages a reduction of potable water use by 30% or more (U.S. Green Building Council, 2001). MEC gains two credits by using *Caroma* dual flush toilets that consume only 0.8 gallons per flush. MEC also uses custom made aerators to reduce water consumption. The total reduction is approximately 70% or 88,167 gallons per year (Prairie Architects Inc., 2002). This earns MEC two points.

4. ENERGY & ATMOSPHERE

Energy and Atmosphere allows for a possible 17 credits and has three main requirements that must be met in order to be considered a suitable LEED building. The MEC building is eligible for 12 of these points as discussed in the following sections.

4.1. Prerequisite: Fundamental Building Systems Commissioning

It is required that fundamental building elements and mechanical systems are designed, installed, and calibrated to operate as intended (U.S. Green Building Council, 2001). A comprehensive program of commissioning the mechanical and electrical systems has been undertaken by Prairie Architects Inc. to ensure all opportunities have been taken to reduce energy loss.

4.2. Prerequisite: Minimum Energy Performance

The LEED system establishes a minimum level of efficiency and performance as per ASHRAE/IESNA 90.1-1999 or more stringent local energy codes (U.S. Green Building Council, 2001). This requirement is fulfilled by the MEC building.

4.3. Prerequisite: CFC Reduction in HVAC&R Equipment

The LEED system requires the reduction or phase out of ozone depleting substances as per the Montreal Protocol. No CFC-based refrigerants are used in the MEC building (Prairie Architects Inc., 2002).

4.4. Optimize Energy Performance

LEED aims to reduce environmental impacts associated with excessive energy use by encouraging increasing levels of energy performance. Credits are earned based on reduction of energy consumption in 10% increments up to 50% for existing buildings and up to 60% for new buildings.

The MEC building has incorporated several conservation programs to increase the efficiency of the building. These programs include a super insulated envelope, a high-efficiency ground source heat pump, in floor radiant heat, passive solar gain, thermal mass in the brick floor, and a passive air conditioning system (Prairie Architects Inc., 2002). Combined, these programs yield an energy savings of 66.9% better than the Model National Energy Code for Buildings (mNECB) and the building is ranked as Canada's most energy efficient commercial building. Incentives provided by the Commercial Building Incentive Program (CBIP) and Manitoba Hydro's Power Smart Program totalled $100,000. An energy model has predicted annual energy savings of $31,570 per year (Prairie Architects Inc., 2002). Based on these efforts, the MEC building earns ten out of a possible ten points for its energy performance.

4.5. Renewable Energy

The LEED system credits the use of renewable energy for 5%, 10%, or 20% of the building's total energy needs (U.S. Green Building Council, 2001). The MEC building uses a ground source heat pump as the main source of heating and cooling. It also uses a 150 watt photovoltaic panel to gain energy from the sun (Prairie Architects Inc., 2002), but this energy is used in the irrigation system. It is unknown what percentages of

renewable energy MEC uses, therefore, it is not awarded any points for using renewable energy.

4.6. Additional Commissioning

LEED awards one point for verifying that the building is designed, calibrated, and operated as intended (U.S. Green Building Council, 2001). The MEC building receives this point for completing comprehensive program of commissioning the mechanical and electrical systems (Prairie Architects Inc., 2002).

4.7. Ozone Depletion

LEED awards one point for installing base level HVAC and refrigeration equipment that do not contain CFC's or halon (U.S. Green Building Council, 2001). MEC is awarded this point for selecting equipment that does not contain CRC's or HCFC's (Prairie Architects Inc., 2002).

4.8. Measurement & Verification

The LEED system encourages ongoing accountability and optimization of building energy and water consumption performance over time (U.S. Green Building Council, 2001). There is no evidence to suggest that MEC has incorporated a measurement and verification plan, therefore, MEC is not awarded the point for this section.

4.9. Green Power

The LEED system encourages the development and use of grid-source energy technologies on a net zero pollution basis (U.S. Green Building Council, 2001). MEC is not awarded this point as there is nothing to suggest that MEC has a green power contract with local utilities.

5. MATERIALS & RESOURCES

Materials and Resources allow for 13 possible credit points in the LEED system. The MEC building is eligible for 12 points as discussed in the following sections.

5.1. Prerequisite: Storage & Collection of Recyclables

The LEED rating system requires the reduction of solid waste in the construction and operation phases of the building (U.S. Green Building Council, 2001). MEC has developed a recycling program for staff and customers. All solid waste is sorted and recycled with a solid waste reduction target of 100% (Prairie Architects Inc., 2002). Composting and recycling bins are utilized.

5.2. Building Reuse

LEED targets 100% reuse of the building's shell and 50% reuse of interior materials (U.S. Green Building Council, 2001). MEC reused the 20,000 square foot building that was onsite prior to construction of the MEC building. The greenhouse gas savings associated with reusing the building is 723 tonnes, the equivalent of more than 20 years of CO_2 saved through energy efficiency. Likewise, the capital cost saving for using building recycling is approximately $400,000 (Prairie Architects Inc., 2002). Therefore all three points are awarded for this section.

5.3. Construction Waste Management

LEED encourages the diversion of construction, demolition, and land clearing debris from landfill disposal. LEED awards one point for recycling 50% and two points for recycling 75% by weight (U.S. Green Building Council, 2001).

Prairie Architects Inc. ensured that every component of construction waste was diverted from the landfill. Partnerships were created with Habitat for Humanity, the local municipality, and local merchants to recover bricks, old machines, tin ceilings, and

hardwood floors. In total 3,657 tonnes of solid waste were diverted from landfills (Prairie Architects Inc., 2002). MEC is therefore eligible for three LEED points.

5.4. Resource Reuse

The LEED system encourages the reuse and recycling of materials including the buildings shell and non-shell components. LEED awards one point for salvaging materials for 5% of the building materials and two points for 10% of the building materials (U.S. Green Building Council, 2001).

The building that was disassembled on site was inventoried and the design of the new building was based on available materials. More than 95% of the existing building by weight was reused, earning MEC two points (Prairie Architects Inc., 2002).

5.5. Recycled Content

LEED awards points for including post-consumer or post-industrial products. One point is earned for a minimum of 25% of post-consumer material and two points for a minimum of 50% of post-consumer material (U.S. Green Building Council, 2001).

Where reclaimed material was not used, material with a high recycled content was utilized in the MEC building. For example, cellulose insulation, made from shredded newsprint, was used in all the walls. It is estimated that less than 1% of the building is constructed with new material. Thus, the MEC building earns two points for using recycled content. (Prairie Architects Inc., 2002)

5.6. Local/Regional Materials

LEED encourages the use of materials within 500km of the site to reduce the costs and impacts of transportation. LEED awards one point for 20% and two points for 50% of materials purchased locally (U.S. Green Building Council, 2001).

Manitoba has limited availability of local materials. In response, Prairie Architects Inc. targeted local employment over imported materials, for example, using existing wall and floor shiplap instead of imported plywood (Prairie Architects Inc., 2002). Thus, the building is awarded two points for using local materials.

5.7. Rapidly Renewable Materials

LEED standards aim to reduce the use and depletion of finite raw and long-cycle renewable materials by replacing them with rapidly renewable materials (U.S. Green Building Council, 2001), which MEC purchased where available. This includes the OSB and Isoboard made of poplar trees and straw, which are utilized in the buildings (Prairie Architects Inc., 2002). Thus, the MEC building is eligible for one LEED point for using a minimum of 5% of rapidly renewable materials.

5.8. Certified Wood

LEED encourages responsible forest management by awarding one point for the minimum use of 50% of wood-based materials certified in accordance with the Forest Stewardship Council Guidelines for wood building components (U.S. Green Building Council, 2001). MEC did not purchase certified wood projects, and therefore is not eligible for this LEED point.

6. INDOOR ENVIRONMENTAL QUALITY

The purpose of this section is to ensure that the building is designed with methods of preventing poor indoor air quality for the sake of the occupants' comfort and well-being. A total of 15 LEED points are associated with *Indoor Environmental Quality;* MEC meets the requirements for 12 of these points.

6.1. Prerequisite - Minimum Indoor Air Quality (IAQ) Performance

LEED stipulates that the HVAC system is designed to meet ventilation requirements put forth by ASHRAE. It is important that any external air intakes are not near sources of contamination. (U.S. Green Building Council, 2001) The MEC building in Winnipeg meets this prerequisite.

6.2. Prerequisite - Environmental Tobacco Smoke (ETS) Control

This LEED credit requires that non-smokers are protected from exposure to tobacco smoke either by prohibiting smoking on site or by having appropriate designated smoking areas. (U.S. Green Building Council, 2001) The MEC building in Winnipeg meets this prerequisite.

6.3. Carbon Dioxide (CO_2) Monitoring

In order to meet the LEED guideline that stipulates an indoor air monitoring system to provides feedback to ventilation systems, the MEC building has incorporated CO_2 sensors that modify outdoor air intake as necessary. (Prairie Architects Inc., 2002) This is worth one LEED point.

6.4. Ventilation Effectiveness

A LEED credit is given for effective delivery and mixing of fresh air. This will support health, safety, and comfort of building occupants. (U.S. Green Building Council, 2001)

A highly efficient ventilation system has been installed in the Winnipeg building in order to balance fresh air intake with energy efficiency by drawing in more outdoor air when the building has more occupants and less when the building is unoccupied (Prairie Architects Inc., 2002). The building is therefore eligible for this LEED point.

6.5. Construction IAQ Management Plan – Before and During Occupancy

In order to prevent indoor air quality problems resulting from the construction process, LEED requires the development and implementation of Indoor Air Quality (IAQ) Management Plans for the construction and preoccupancy phases of the building. worth one point each (U.S. Green Building Council, 2001). MEC qualifies for the point given for the construction phase only.

6.6. Low-Emitting Materials

With respect to indoor air contaminants, the LEED guidelines encourage the reduction of the quantity of odorous or potentially irritating substances, with occupant health and comfort in mind. (U.S. Green Building Council, 2001)

The building materials (such as paints, adhesive, flooring) for the MEC site were all chosen in an attempt to have minimal vapours emitted. The paints are *Ecologo* certified. Composite woods, sealants, and caulking were chosen because of their low VOC ratings. Reclaimed brick and hardwood were used on the floors instead of carpeting. (Prairie Architects Inc., 2002) For these choices, MEC would earn three points. An additional LEED credit would be given if they had also chosen low-emitting carpet, but since they did not use carpet this point is unavailable to them.

6.7. Indoor Chemical & Pollutant Source Control

The LEED guidelines stipulate that building occupants are not exposed to potentially hazardous chemicals in the indoor air. (U.S. Green Building Council, 2001) MEC meets this requirement worth one point.

6.8. Controllability of Systems and Thermal Comfort

One or two LEED points are given for providing a high level or occupant control of thermal, ventilation, and lighting systems in order to promote health, productivity, and comfort conditions. Another point is given for providing a thermally comfortable

environment, and yet another for a thermal monitoring system (U.S. Green Building Council, 2001)

The MEC building has under floor, radiant heating with flexible zoning that provides a high level of control, making them eligible for one of the *Thermal Comfort* credits. Operable windows in the building allow for passive cooling. Energy efficiency of the lighting is optimized through occupancy sensors and individual controls, making the building eligible for two *Control* points. (Prairie Architects Inc., 2002)

6.9. Daylight & Views

LEED accreditation provides up to two points for establishing a connection between indoor spaces and outdoor environments that allow for sunlight in the building and views into the occupied areas of the building. (U.S. Green Building Council, 2001)

There is a three story natural light monitor in the center of the building, providing a high level of daylight to the core of the building, making the project eligible for two LEED points. The surrounding fluorescent lights are on photocells that begin to shut off as the daylighting increases (Prairie Architects Inc., 2002).

7. INNOVATION & DESIGN PROCESS

Innovation and Design Processes allow for 5 possible points. MEC is eligible for all 5 points as discussed in the following sections.

7.1. Innovation in Design

Points are awarded for exceptional performance above requirements set by the LEED system. The MEC in Winnipeg has been recognized as one of the most efficient buildings in Canada. It earns one point each for innovation in urban development, innovation in energy performance, innovation in building reuse, and innovation in environmental education to its patrons, for a total of four points.

7.2. LEED Accredited Professional

LEED awards one point if one principle participant in the project has completed the LEED Accredited Professional Exam. Prairie Architects have verified that architects working on the MEC project are LEED certified, earning the project one LEED credit.

8. REFERENCES

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