Fifth Town Artisan Cheese Co. located in Picton, ON has achieved a LEED Platinum accreditation and used sheet steel building products to earn LEED points.

# LEEDing with STEEL 2009

Read about the contribution steel can make towards obtaining a LEED® green building rating for your project.

September 2010

## CONTENTS



CSSBI
Canadian Sheet Steel Building Institute

Buildings have a profound impact on our natural environment, economy, health and productivity. In North America, the built environment accounts for approximately one-third of all greenhouse gas emissions, energy, water and material consumption and generates similiar proportions of pollution. Indoor air quality is regarded as one of the top environmental health risks today, affecting the well-being, productivity and performance of many people.

As concerns increase about sustainability in building design and operation, there is a need to develop a framework for assessing and quantifying buildings so that questions such as, "What is sustainable design?" and "How green is this project?" can be addressed. In response to this, the Leadership in Energy and Environmental Design (LEED) green building rating system was developed to provide such a framework for North America. This document explores how the use of steel structures and components can contribute to achieving a LEED certificate for a building.

# Introduction to LEED®

**(Leadership in Energy and Environmental Design)**

## What is LEED?

The LEED system was developed to provide a standard for what constitutes a "sustainable building" and to transform existing building markets so that sustainable design, construction and operation become mainstream practices. The approach taken was to create a *"voluntary, consensus-based, market driven building rating system based on proven technology"*.[1] LEED aims to improve occupant well-being, environmental performance and economic returns from buildings, using both established and innovative practices, standards and technologies. It is also intended to prevent exaggerated or false claims of sustainability and to provide a common standard of measurement.

LEED was first developed by the US Green Building Council (USGBC) and adopted in the USA. In 2004, the Canadian Green Building Council (CaGBC) created LEED Canada - NC version 1.0. At present it applies to new designs and major renovations of commercial, institutional or high-rise residential buildings. But in June 2010, a new version has taken effect, LEED Canada for New Construction and Major Renovations 2009. The discussion to follow will give details on both versions as there are some differences between the two.

LEED offers a third-party certification process whereby points are collected within five main environmental performance categories for version 1.0 and six main categories for the 2009 version (see Table 1). Both versions have a category that deals with *Innovation and Design Process/ Innovation in Design* and aims to promote whole-building integrated design practices. LEED Canada NC 2009 has a seventh category that deals with *Regional Priority*.

LEED represents a consensus-based approach of the members of the USGBC and CaGBC, which include a wide cross-section of designers, suppliers, clients, regulators and other interest groups. As of September 2010, 289 buildings were LEED certified in Canada, and 2,400 projects were registered seeking LEED certification.

**This document is based on the requirements of LEED Canada NC version 1.0 and LEED Canada NC 2009, which vary in detail compared to LEED version 3 used in the USA.**

## Benefits of LEED Certification

Well documented benefits of employing sustainable building technologies include measurable reductions of waste, decreased water use, energy savings, reduced operating and maintenance costs and improved indoor air quality. Less tangible benefits may include improvements in occupant health, employee morale, productivity, recruitment and improved public image for organizations that build green. Research studies[2] point to links between sustainable buildings and improved labour productivity - a business expense that dwarfs other building operating expenses.

Incorporating sustainable features also helps to "future-proof" a building for tomorrow. With rising utility costs, more demanding indoor environmental quality standards and concerns about the impact of some materials on the environment, new buildings that do not address these issues may find themselves at a competitive disadvantage in the future.

**Table 1 ·** LEED credit categories - prerequisites and points available in each

LEED Canada NC version 1.0 points are divided into credits, organized within 6 core categories. LEED Canada NC 2009 points are divided into credits, organized within 7 core categories listed below:

| Categories | Prerequisites | | Number of Points | |
|---|---|---|---|---|
| | Version 1.0 | 2009 | Version 1.0 | 2009 |
| Sustainable Sites | 1 | 1 | 14 | 26 |
| Water Efficiency | 0 | 1 | 5 | 10 |
| Energy and Atmosphere | 3 | 3 | 17 | 35 |
| Materials and Resources | 1 | 1 | 14 | 14 |
| Indoor Environmental Quality | 2 | 2 | 15 | 15 |
| Innovation and Design Process/ Innovation in Design | 0 | 0 | 5 | 6 |
| Regional Priority (2009 version only) | NA | 0 | NA | 4 |

LEED Canada NC version 1.0 includes a maximum of 70 possible points. LEED Canada NC 2009 includes a maximum of 110 possible points. To be LEED certified under either version, all the prerequisites must be met and a minimum number of points scored. (see Table 2)

## How steel can contribute to LEED credits

The following sections review the relevant LEED Canada NC version 1.0 and LEED Canada NC 2009 categories for which steel components can contribute to earning LEED points.

LEED accreditation helps to identify leaders in sustainable design and serves as a marketing tool that can be used by building owners to generate increased returns. LEED can also be used to raise consumer awareness of the importance of sustainable design. In addition, many organizations are now requiring LEED certification for their buildings.

It should be noted that most of the points require a coordinated approach by the design team and cannot be achieved merely by using a particular material or technology. Nevertheless, it may be possible to to achieve some points merely by using steel, and **use of steel components can contribute to obtaining over 30 points in LEED Canada NC version 1.0 and over 50 points in LEED Canada NC 2009 as part of a holistic approach.**

## Sustainable Sites (SS)

This section deals with issues related to site selection (brownfield vs. greenfield), site design (materials, density, drainage), site access (transport issues and availability of facilities), heat island effects and light pollution effects.

**Version 1.0 - 1 prerequisite and 14 points.**
**2009 version - 1 prerequisite and 26 points.**

| | version 1.0 | 2009 |
|---|---|---|
| Credit # | 2 | 2 |
| Credit Title | Development Density | Development Density and Community Connectivity |
| Points | 1 | 3 or 5 |

This credit is designed to channel development into urban areas with existing infrastructure, protecting greenfield sites.

Using steel structures and components can help address many of the problems of building in urban centres. Engineered, prefabricated steel components can be speedily installed reducing construction time and disruption on the site. Furthermore, the flexibility that steel design offers enables difficult urban sites to be more readily exploited. The wide spanning capabilities, fast-tract construction, integration of services, just-in-time delivery, reduced storage requirements, less disruption on cramped sites and lighter weight of steel buildings leading to smaller foundations, all contribute to more workable steel solutions on difficult urban sites. In addition, many steel technologies such as steel pile foundations and roof and wall cladding require little removal of waste from site.

**Increasingly, developers in Europe are using steel frame for both residential and commercial building in tight city centre sites due to the speed, prefabrication and reduced disruption.**

| | version 1.0 | 2009 |
|---|---|---|
| Credit # | 3 | 3 |
| Credit Title | Redevelopment of Contaminated Sites | Brownfield Redevelopment |
| Points | 1 | 1 |

This credit aims to focus development on previously used industrial or commercial sites with real or perceived environmental contamination.

As with urban sites, contaminated (brownfield) site developments can benefit from the use of lightweight structures that require less ground work and large-scale prefabrication using steel components which can reduce disturbance of the polluted ground. In some cases this can lead to more cost-effective remediation solutions to deal with the contamination.

| | version 1.0 | 2009 |
|---|---|---|
| Credit # | 5.1 | 5.1 |
| Credit Title | Reduced Site Disturbance: Protect or Restore Open Space | Site Development: Protect or Restore Habitat |
| Points | 1 | 1 |

This credit includes 1 point for protecting or restoring open space in order to conserve existing natural areas. To achieve this credit the disturbance due to development must be contained within strict limits.

**Table 2 ·** Certification Levels - version 1.0 and 2009

| Certification Level | LEED Canada NC version 1.0 | LEED Canada NC 2009 |
|---|---|---|
| Certified | 26 - 32 points | 40 - 49 points |
| Silver | 33 - 38 points | 50 - 59 points |
| Gold | 39 - 51 points | 60 - 79 points |
| Platinum | 52+ points | 80+ points |

## How steel can contribute to LEED credits

The use of steel structures and components allows much more prefabrication. A key feature of prefabrication is that much of the process is removed from the site to controlled factory conditions. Reducing the amount of time spent onsite can lead to less detrimental impacts on the site and locality. The use of steel provides the opportunity for management systems that reduce site disturbance.

**Prefabricated hotel buildings can be constructed onsite in half the time (or less) of a traditionally built hotel of a similar size, and with less disruption in the locality. This could be reduced further with the use of factory applied claddings. In the catering industry, clients have claimed an improvement by a factor of 10 in construction and commissioning timescales for a typical fast food restaurant when using volumetric construction.**

Figure 1 · Prefabrication can reduce impact of work on site

| | version 1.0 | 2009 |
|---|---|---|
| Credit # | 7.2 | 7.2 |
| Credit Title | Heat Island Effect: Roof | Heat Island Effect: Roof |
| Points | 1 | 1 |

This credit includes 1 point for the use of roof surfaces that are EnergyStar compliant, with a high reflectance and emissivity to reduce cooling loads.

Steel roofing and cladding materials are available that meet the EnergyStar labeled requirement with reflectance greater than 0.65 and emissivity greater than 0.9. See:

- http://www.coolmetalroofing.org
- http://www.energystar.gov/index.cfm?c=roof_prods.pr_roof_products

## Energy and Atmosphere (EA)

This category encompasses a number of strategies to help reduce energy use and exploit renewable energy sources to cut greenhouse gas emissions. Other measures aim to protect the ozone layer.

**Version 1.0 - 3 prerequisites and 17 points. 2009 version - 3 prerequisites and 35 points.**

| | version 1.0 | 2009 |
|---|---|---|
| Prereq. # | 2 | 2 |
| Prereq Title | Minimum Energy Performance | Minimum Energy Performance |
| Points | NA | NA |

This prerequisite requires that all LEED certified buildings achieve a base level of energy efficiency. See Table 3 for the levels proposed for new buildings in Canada.

| | version 1.0 | 2009 |
|---|---|---|
| Credit # | 1 | 1 |
| Credit Title | Optimize Energy Performance | Optimize Energy Performance |
| Points | 1-10 | 1-19 |

In addition this credit offers further points (up to 10 points under version 1.0 and up to 19 points under 2009) for new buildings if the energy cost is reduced between:

| | version 1.0 | 2009 |
|---|---|---|
| MNECB | 24%-64% | 25%-56% |
| ASHRAE 90.1 | 15%-60% (90.1-1999) | 12%-48% (90.1-2007) |

For major renovations, less demanding standards are set. Meeting the base standards is generally cost-effective and good business practice. Steel structures can be readily designed to achieve the base levels of energy efficiency required and score additional points depending on the detailed design of the building, its location and fuel type used. Examples in Canada include the many light steel frame residential buildings constructed to the demanding R2000 energy efficiency

**Table 3** · Base level of energy efficiency

| | version 1.0 | 2009 |
|---|---|---|
| Model National Energy Code for Buildings (MNECB) reference building | 25% reduction in energy consumption | 23% reduction in energy cost |
| ASHRAE Standard 90.1 | 18% reduction in energy cost (90.1-1999) | 10% reduction in energy cost (90.1-2007) |

## How steel can contribute to LEED credits

standards. Also, steel frame offices can accommodate high levels of insulation and flexible servicing strategies to maximize efficiency.

The energy calculations required for this credit entail the use of thermal modeling software such as DOE 2.1 to enable designers to investigate, optimize and demonstrate the full annual energy performance. These models allow the effects of thermal mass to be accurately modelled to demonstrate and maximize the potential benefits. Thermal mass is important in buildings for its heat storage capacity, particularly in the cooling season. However, it is not the absolute amount of mass that is important but how well it is distributed, and how well it is connected with the occupied spaces. Studies have shown that sufficient thermal mass can be readily incorporated in steel frame office buildings to reduce cooling loads, and that the structural framing makes little difference to cooling loads.[3] The designer should focus on ensuring that the mass which is present for structural requirements is used effectively for cooling. This means careful specification of finishes to ensure that the mass is not insulated from the internal spaces.

| | version 1.0 | 2009 |
|---|---|---|
| Credit # | 2.1/2.2/2.3 | 2 |
| Credit Title | Renewable Energy: 5%, 10%, 20% | On-Site Renewable Energy |
| Points | 1-3 | 1-7 |

This credit offers up to 3 points under version 1.0 or up to 7 points under 2009 for technologies that generate on-site renewable energy for 5-20% (version 1.0) or 1-13% (2009) of the building's total energy use.

Steel cladding is becoming increasingly available with photo-voltaic cells integrated into their surface which can generate on-site electricity. These can be used to gain points under this credit.

## Materials and Resources (MR)

This section focuses on building and component reuse, waste management and use of recycled, certified and local or regional materials. This section includes complex rules about definitions and measurement methods which affect steel recycling percentages.

**Version 1.0 - 1 prerequisite and 14 points.**
**2009 version - 1 prerequisite and 14 points.**

| | version 1.0 | 2009 |
|---|---|---|
| Credit # | 1.1/1.2 | 1.1 |
| Credit Title | Building Reuse: 75%/95% of Existing Walls, Floors and Roof | Building Reuse: Maintain Existing Walls, Floors and Roof |
| Points | 1-2 | 1-3 |

This credit offers points for extending the life of existing buildings thus conserving materials that would have been used for a new building. More points are awarded when greater proportions of the existing building are reused.

### Case Study: R2000 residential steel - Envirotec home - Richmond Hill, Ontario

Lightweight steel framing can be used for residential construction to meet the high energy efficiency requirements of the R2000 program. The 300m$^2$ home, located in Richmond Hill, Ontario, is one of many R2000 homes constructed of lightweight steel framing with high-performance insulation from foundation to roof. Steel framing makes use of recycled waste material and avoids shrinkage and nail pop problems associated with wood frame buildings.

Figure 2 · Typical lightweight steel frame construction

The house integrates an advanced whole-house ventilation system with HEPA air filters and secondary ventilation of all closet areas, a very efficient Viesmann gas-fired boiler and radiant in-floor heating system.

In designing the home, particular attention was paid to measures that would provide clean and fresh indoor air. All finishes, flooring and surfaces are non-toxic. In-floor radiant heating ensures a high level of comfort while reducing the potential for mould growth and moisture problems.

The home also has an EnviroHome designation, which is given to a select number of new home projects across Canada that go beyond the R2000 requirements to include additional air quality and environmental features.

## How steel can contribute to LEED credits

Steel buildings are flexible and are suitable for reuse. They are also often readily extendable and adaptable to new uses. In refurbishment, modifying and reinforcing of existing structures is an important attribute of steel structures. There are many examples of steel structures that have been adapted for a new use, while in some cases steel structures have been dismantled and reassembled in a new location. In addition, the lightweight characteristics of steel structures mean that often additional floors can be added to existing buildings, extending their usefulness.

**An example of complete reuse of a steel structural system is the Beaver Stadium at Penn State University. In this case, the entire steel structure was unbolted, dismantled and relocated at a nearby location.**

| | version 1.0 | 2009 |
|---|---|---|
| Credit # | 2.1/2.2 | 2 |
| Credit Title | Construction Waste Management: Divert 50%/75% from Landfill | Construction Waste Management |
| Points | 1-2 | 1-2 |

This credit aims to address the huge volume of construction waste generated. One or two points are available for diverting 50% or 75% of the weight of construction, demolition and land clearing debris from landfill disposal.

Steel is a valuable material and is generally either recycled or reused when occurring as part of construction or demolition waste. Thus, any steel generated from demolition can be readily sent for recycling or reuse, generating significant benefit for this credit. In addition, the use of steel components on-site generates very little waste, as the components are generally manufactured to tight tolerances in a factory and delivered to site for assembly. Any steel off-cuts that may arise are valuable and can be readily recycled. Thus, using steel structures and other steel components should contribute significantly to reducing site waste.

| | version 1.0 | 2009 |
|---|---|---|
| Credit # | 3.1/3.2 | 3 |
| Credit Title | Resource Reuse: 5%/ 10% | Materials Reuse |
| Points | 1-2 | 1-2 |

This credit aims to extend the life cycle of building components by specifying salvaged or refurbished components. This saves the resources

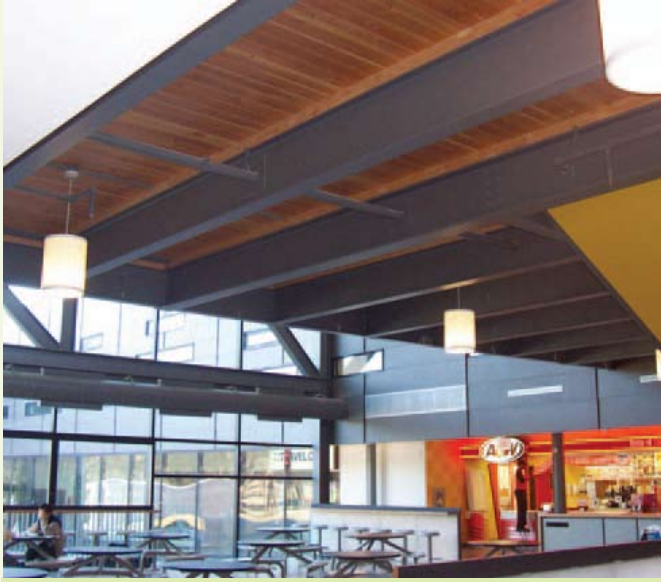

Figure 3 · The University of Toronto Scarborough Campus Students' Centre uses reclaimed steel.

needed to produce new components. One or two points are available if 5% or 10% of the total value of building materials comes from salvaged sources.

Many steel components that are recovered from demolition or refurbishment projects are suitable for reuse. This includes structural sections, cladding, studs and smaller components. Increasingly, designers are sourcing recovered steel components and are specifying their use in new projects.

**Examples of major projects where recovered steel has been used include the Students' Centre for the University of Toronto Scarborough Campus (UTSC). The engineers for this project were also working on renovations to the Royal Ontario Museum (ROM) where demolition work provided steel components suitable for use in the new Students' Centre. This helped to meet the students' aims to address issues of the environment in their new building. Another example is the Philips Ecoenterprise centre in Minneapolis which use 189 steel joists from a demolished warehouse saving an estimated 50 tonnes of steel.**

This credit is calculated using the value of the reused material. Since steel components often have a relatively high value compared to other building materials, they can contribute considerably to achieving this credit. LEED requires that the salvage status of each component be validated, but if the cost of reused components is lower than the new product equivalent it allows the equivalent market value of new products to be used in the calculations.

## How steel can contribute to LEED credits

| | version 1.0 | 2009 |
|---|---|---|
| Credit # | 4.1/4.2 | 4 |
| Credit Title | Recycled Content: 7.5%/15% | Recycled Content (10%, 20%) |
| Points | 1-2 | 1-2 |

This credit aims to increase demand for building materials such as steel that incorporate recycled content. LEED Canada NC 2009 has more demanding requirements than LEED Canada NC version 1.0. Both differentiate between post-consumer waste and post-industrial waste. One point is available if the sum of the post-consumer recycled content plus one-half of the post-industrial recycled content constitutes at least 7.5% (version 1.0) or 10% (2009) of the total value of the material for the project (see Table 4). A second point is available if these proportions are doubled.

Steel structures and components can contribute significantly to achieving this LEED credit. One of the greatest environmental advantages of steel is its recycled content. Steel can be recycled an infinite number of times without loss in quality. Thus, a piece of steel can be a can, then a car and then a beam in a building, and be continually recycled. There is no contamination or deterioration of steel construction products made of recycled content, and steel processes provide a reliable recycled product that is truly recyclable. The infrastructure for steel recycling is well established, and its magnetic qualities make it easily extracted from the waste stream.

In nature, waste is food, and in steel production, recovered steel is "food" for new production. Steel is produced through one of two methods: the Basic Oxygen Furnace (BOF) which typically uses about 25% scrap steel, and the Electric Arc Furnace (EAF) which can use greater than 95% scrap steel.

In Canada, both processes are used for sheet steel building products such as roofing, cladding, steel studs, decking and floor joists. LEED certification requires documentation from the steel suppliers verifying the recycled content and manufacturing process. This is available from steel producers, from the AISI website (www.steel.org) or from the CSSBI website (www.cssbi.ca). The value of a steel frame in a building may in some cases itself be sufficient to account for the required value of materials to achieve this credit.

| | version 1.0 | 2009 |
|---|---|---|
| Credit # | 5.1/5.2 | 5 |
| Credit Title | Regional Materials: 10%/20% Extracted and Manufactured Regionally | Regional Materials (20%, 30%) |
| Points | 1-2 | 1-2 |

This credit is intended to increase demand for locally manufactured materials thereby reducing the environmental impacts of transportation and supporting the local economy.

To achieve 1 point, 10% (version 1.0) and 20% (2009) of materials (measured by value) must be extracted, processed and manufactured within 800km of the site, or if rail or water transport is primarily used this distance is extended to 2,400km. For a second point, 20% (version 1.0) or 30% (2009) of materials must meet this requirement. Most scrap used in Canada is from local sources located close to the steelmaking operations.

Figure 4 · Bolted connections allow disassembly facilitating easier reuse

**Table 4** · Total recycled content for steel building products manufactured in Canada

| Steelmaking Source | Typical Total Scrap Content (%) |
|---|---|
| Electric Arc Furnace (EAF) | >95% |
| Basic Oxygen Furnace (BOF) | 25% |

## How steel can contribute to LEED credits

## Indoor Environmental Quality (IEQ)

This section focuses on occupant comfort, indoor air quality, thermal comfort and access to daylight.

**Version 1.0 - 2 prerequisites and 15 points.**
**2009 version - 1 prerequisite and 14 points.**

| | version 1.0 | 2009 |
|---|---|---|
| Credit # | 4.1 | 4.1 |
| Credit Title | Low-Emitting Materials: Adhesives and Sealants | Low-Emitting Materials: Adhesives and Sealants |
| Points | 1-2 | 1-2 |

This credit requires that any adhesives or sealants used in the interior of the building comply with South Coast Air Quality Management District (SCAQMD) Rule #1168. Sealants and/or adhesives are sometimes used in interior applications of sheet steel building products (for example liner panel). There are sealants and adhesives available that are appropriate for these applications that meet the standards in the SCAQMD Rule #1168.

| | version 1.0 | 2009 |
|---|---|---|
| Credit # | 4.2 | 4.2 |
| Credit Title | Low-Emitting Materials: Paints and Coatings | Low-Emitting Materials: Paints and Coatings |
| Points | 1 | 1 |

This credit aims to reduce the quantity of indoor air contaminants. One point is available if paints adhering to the Green Seal requirements are used. Steel components are usually painted off-site under controlled conditions. This reduces emissions into the building. Low-emitting paints and coatings can be used on steel to meet this credit requirement.

| | version 1.0 | 2009 |
|---|---|---|
| Credit # | 8.1 | 8.1 |
| Credit Title | Daylight and Views: Daylight 75% of Spaces | Daylight and Views: Daylight |
| Points | 1 | 1 |

| | version 1.0 | 2009 |
|---|---|---|
| Credit # | 8.2 | 8.2 |
| Credit Title | Daylight and Views: Views for 90% of Spaces | Daylight and Views: Views |
| Points | 1 | 1 |

Two points are available for a credit to maximize daylight and views. One point is achieved if the prescribed daylight levels are achieved for at least 75% of the principal spaces. A second point is available if 90% of all regularly occupied spaces have a view to the outside.

The adaptability of steel structures, cladding and partitioning can provide the designer with flexibility and scope to provide good daylighting, and the maintenance of unobstructed views, thus meeting the requirements of these credits.

## Innovation and Design Process/Innovation in Design (ID)

**Version 1.0 - 0 prerequisites and 5 points.**
**2009 version - 0 prerequisites and 6 points.**

| | version 1.0 | 2009 |
|---|---|---|
| Credit # | 1 | 1 |
| Credit Title | Innovation in Design | Innovation in Design |
| Points | 1-4 | 1-5 |

| | version 1.0 | 2009 |
|---|---|---|
| Credit # | 2 | 2 |
| Credit Title | LEED Accredited Professional | LEED Accredited Professional |
| Points | 1 | 1 |

This section allows a building to obtain up to 4 (under version 1.0) or up to 5 (under 2009) design innovation points, as well as one additional point for including a LEED accredited professional in the design process.

Credits for Innovation in Design may be awarded for strategies that go significantly beyond what is required in the other LEED credits or for new ideas not covered elsewhere. Steel may contribute some innovative solutions - possible options include design for future demountability and reusability, use of composite members to reduce material volume, use of innovative steel structural solutions that reduce material volume, and integration of structure and services.

## How steel can contribute to LEED credits

**For example the Utah Olympic Speed Skating Oval uses an innovative cable suspension system to support a very shallow steel truss roof, which weighs about 600 tonnes (25%) less than competing solutions. The design also reduces the internal volume by about 20% which results in a smaller HVAC system and less energy used for heating and cooling.**

Creative use of prefabrication to mazimize environmental benefits and improve Health and Safety of the workforce is another option. Moving much of the process into more controlled and comfortable factory conditions enables safety requirements to be more easily met and policed, and healthy and comfortable working conditions are more readily maintained.

To support design integration, 1 LEED point is available if the design team includes a LEED Accredited Professional. The steel industry can offer LEED accredited professionals the opportunity to work with project teams.

## Regional Priority (RP)
### *New category for 2009

**Version 1.0 - This category is not included in version 1.0**
**2009 version - 0 prerequisites and 4 points.**

| | version 1.0 | 2009 |
|---|---|---|
| Credit # | MR Credit 8 | 1 |
| Credit Title | Durable Building | Durable Building |
| Points | 1 | 1 |

Note: In version 1.0, this credit is listed under the *Materials and Resources* category. In version 2009, it has been moved to the new category of *Regional Priority*.

The intent of this credit is to minimize material use and construction waste over a building's life resulting from premature failure of the building and its components and assemblies.

In order to acquire this point, a Building Durability Plan must be developed and implemented according to the standard *CSA S478-95 - Guideline on Durability in Buildings*. As steel is a durable product with a long life-cycle, it can be incorporated into any building project to achieve the necessary requirements of any Building Durability Plan.

## Case Study: Roy Stibbs Elementary School

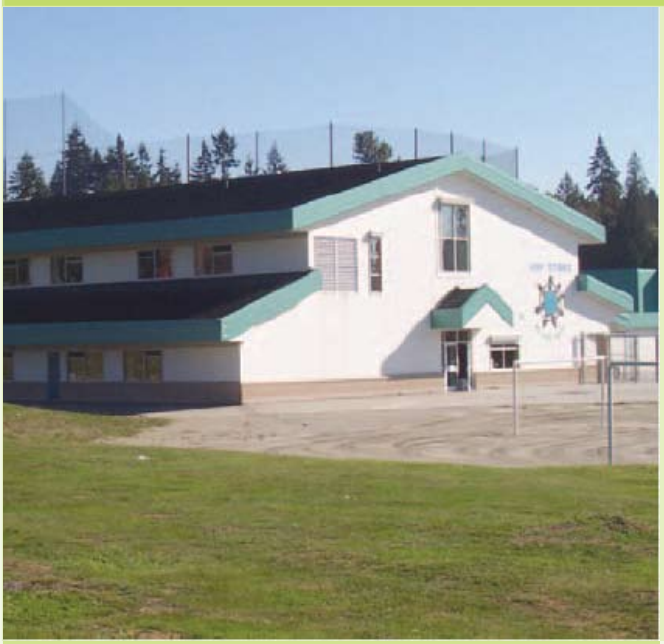

Figure 5 · Roy Stibbs Elementary School, BC

An example of the reuse of steel is the Roy Stibbs Elementary School in Burnaby, BC, Canada. A new classroom wing was constructed using steel members from an abandoned steel-framed school building in northern British Columbia. The school was dismantled and 75% of the structure was re-erected in Burnaby for use in the new facility using the original shop drawings. Independent materials-testing ensured that any damage caused by the dismantling or transportation was identified properly and repaired. The structure was strengthened through the addition of chevron braces. The reuse of materials also saved several months in the project schedule.

This project highlights the important conditions that aid in demountability and recovery of components. Reliance on mechanical fastening rather than chemical bonding methods (welding, etc.) allows connections to be more easily disassembled. Structural systems that avoid monolithic components, and use easily demountable components, such as non-composite structural steel or untopped precast concrete are more readily reused.

## Canadian Steel Construction Sector

The Canadian steel industry has been active for many years in reducing the environmental impacts of its activities. Below are some of its achievements:

- Reduced carbon dioxide ($CO_2$) emissions by more than 20% since 1990, surpassing the target set out in the Kyoto Protocol.
- Reduced absolute GHG emissions by 17% since 1990.
- Reduced GHG intensity by 29% since 1990.
- Reduced sulphur dioxide ($SO_2$) emissions by 76% since 1990.
- Reduced nitrogen oxide ($NO_x$) emissions by 31% since 1990.
- Reduced polycyclic aromatic hydrocarbons (PAH) emissions by 74% since 1993.
- Improved energy efficiency by 26% since 1990.
- Reduced waste going to landfill by 52% between 1994 and 2002.
- Over 7.7 million metric tons of steel recycled in 2008.

The industry is taking a life cycle approach - steel is the most recycled material in the world - more than aluminum, glass and paper combined. Steel recycling in construction is continually on the rise and its recycling rate tops 95%.[4]

Figure 6 · The steel recycling infrastructure is well established

## Further Information

| | |
|---|---|
| www.cssbi.ca | Canadian Sheet Steel Building Institute (CSSBI) is the national association of companies involved in the sheet steel industry. |
| www.recycled-steel.org | The Steel Recycling Institute is an industry association that promotes and sustains the recycling of all steel products and educates about the benefits of steel recycling. |
| www.cisc-icca.ca/green | The Canadian Institute of Steel Construction is the national industry organization representing the structural steel, open web steel joist and steel platework fabricating industries. |
| www.aisc.org/sustainability | The American Institute of Steel Construction website includes resources on sustainability of steel. |
| www.cagbc.org | The Canadian Green Building Council administers the LEED Canada NC rating and provides general information and case studies. |
| www.usgbc.org/LEED | The U.S. Green Building Council is a non-profit coalition of organizations from across the North American building industry promoting high-performance green buildings that are environmentally responsible, profitable, and healthy places to live and work. The USGBC developed LEED as a voluntary, consensus-based national standard to support and validate successful green building design, construction and operations. |
| www.energystar.gov | Website provides information on Energy Star rated products. |

The original version of this document was prepared for the CSSBI by Dr. Mark Gorgolewski, Associate Professor at the Department of Architectural Science at Ryerson University, Toronto, Canada. This is the second edition of the document, updated September, 2010 by the CSSBI.

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3. Barnard, N., Making the most of thermal mass, Architects Journal, 21 October 1999 Barnard, N. et al, Modelling the performance of thermal mass, BRE Information Paper IP6/01, Building Research Establishment, UK

4. Steel Recycling Rates datasheet from the Steel Recycling Institute

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