A s the effects of global warming become more apparent, the green building movement continues to show growing momentum. There is little doubt that incorporating more sustainable practices into the design of buildings has increased the general level of complexity of every project, and guidance is needed to help designers make the appropriate choices.

While there is no single “right answer” when making material selections in green building design, structural steel systems have been chosen in many recent green and LEED™ certified examples. Steel is able to respond to the underlying “waste not” premise of sustainable design to reduce, reuse and recycle our limited natural resources. Although recycled content can vary from mill to mill, the Basic Oxygen Furnace uses 20 to 25% recycled content and the Electric Arc Furnace up to 90% recycled steel. Therefore a significant percentage of the steel sold today comes from recycled, post-consumer content, rather than from newly mined ore. Steel can support the “Cradle to Cradle” idea of sustainable design as described by famed activist William McDonough, through design for disassembly and pre-visionsing a closed loop for steel that avoids contributing to the waste stream.

**REDUCE! REDUCE MATERIAL**

Steel has the ability to create sections that take advantage of the lightest material in the production of structural steel shapes. This is the case for wide-flange sections, HSS sections and open-web steel-jists systems, which allows for streamlined use of the material that is not possible in rectangular structural members that must use solid cross sections. This lightness of structure translates into not only less general use/weight of the material, but reduced transportation and foundation costs. HSS sections can additionally reduce the amount of coating material required when compared to the surface area of wide-flange sections vs. a hollow section of equal carrying capacity.

**REDUCE LABOUR**

The industrialized nature of the shop fabrication and construction process of structural steel systems can reduce site work and simplify erection procedures, which translates into reduced labour and travel associated CO2 costs. The new LEED™ Gold Stratus Winery in Niagara-on-the-Lake, by Les Andrew Architect Inc., chose to use steel as the structure for the main portion of the building that houses the wine making process.

The project makes a point of choosing steel products as a means to increase its sustainability. The building works towards achieving a “long life” through the choice of durable materials. All of the structural steel and the exterior panels of the building (including the roof) are galvanized. This adds to their longevity and eliminates the need for re-painting or re-surfacing in the future. The project called for flexibility, and this was achieved by designing a large-span steel-framed building with a mezzanine suspended from the frame. This design opens up the floor space and allows for ease of modification for future process designs. The main steel structural frame of the building has been designed to accommodate the present structural loading, as well as connections needed for future expansion plans. This building contained 40% post-consumer and 29% post-BiB recycled content, which was useful in obtaining LEED™ credits in the Materials and Resources Category.

**REDUCE TRANSPORTATION**

With rising fuel costs and the movement to reduce carbon emissions, mills and manufacturers across Canada are in limiting travel distances to the construction site, thus reducing the embodied energy of the material. To obtain LEED™ credits for regional materials, both the source of the steel and fabricator must be located no further than 500 miles from the project if the material is trucked, or 1,500 miles if the material is shipped by rail or water. Currently, the distance between the source and the fabricator is not included in the calculation. Check out the locations of CSC fabricator members at www.csc.ca to find the fabricators closest to your project.

**REDUCE FINISHES**

The use of Architecturally Exposed Structural Steel (AESS) brings attention to the design and all its attributes. The material can provide unique architectural expression, and requires no further covering or cladding finishes, it also reduces the use of “other materials”. This saves resources, the labour to install coverings, and associated energy. Fire-resistant intumescent coating systems allowed for exposed steel expression in a multitude of building occupancies. The use of Architecturally Exposed Structural Steel (AESS) brings attention to the design and all its attributes. The material can provide unique architectural expression, and requires no further covering or cladding finishes, it also reduces the use of “other materials”. This saves resources, the labour to install coverings, and associated energy. Fire-resistant intumescent coating systems allowed for exposed steel expression in a multitude of building occupancies.

**REUSING STEEL**

The National Works Yard in Vancouver, a LEED™ Gold facility designed by Omicron Engineering used exposed steel on the facade to support the large overhangs that provide solar shading to the south side of the building. In addition, on the interior of the building, the articulated steel creates architectural expression in the lobby and atrium area. The largesteel supported overhangs also allow the use of a large, open space with clerestories and clerestory lights in the weather. The choice of steel assisted in ensuring that there was over 30% recycled content in the building materials, as well as over 50% of the materials able to be obtained locally, reducing transportation and associated CO2 emissions.

Not all exposed steel need be designed to use custom members and specialized systems. The Seminolehills Library and RCMP Headquarters in Surrey, British Columbia, that obtained a LEED™ Silver rating, used a factory straighten open-web steel-joist system, steel decking and a wide-flange HSS support system, in an expressed column to create the lightness of the interior environment. The clerestory glazing system highlights the white finish on the exposed steel.

**DURABILITY**

Structural steel, if properly designed, detailed and coated, is a durable material for both interior and exposed exterior applications. Durability is one of the uniquely Canadian credits in our version of LEED™ Canada 1.0 for New Construction. However, there are many current projects that exploit the durable characteristics of steel that have not sought environmental certification.

As could be seen in the Stratus Winery, galvanized steel has become a popular finish and is responding to issues of aesthetic choice as well as durability for exterior applications. The Cirque du Soleil Headquarters in Montreal, designed by Architect Dan S. Hongaru, uses simple standard steel sections with a galvanized finish as the solar control devices to reduce heat gain in the building, as well as provide visual interest to the façade.

Galvanized steel was also chosen as the finish for the varied steel elements that were used in creating the Prince Edward Viaduct Safety Store, in Belleville, Ontario. This project was a LEED™ Silver rating. The building has been designed to be both fire resistant and to meet the LEED™ requirements. The building is being constructed from a combination of steel and concrete, with the steel being a structural element. The steel sections are designed to be lightweight and to meet the fire resistance requirements. The use of steel in this project is consistent with the principles of green building and sustainable design.

A number of recent buildings that have achieved recognition have employed reused steel as part of their green design plan. The use of Architecturally Exposed Structural Steel (AESS) brings attention to the design and all its attributes, including the lightness of the interior environment. The clerestory glazing system highlights the white finish on the exposed steel. The use of Architecturally Exposed Structural Steel (AESS) brings attention to the design and all its attributes, including the lightness of the interior environment. The clerestory glazing system highlights the white finish on the exposed steel.

**SUMMER 2006 ADVANTAGE STEEL**

by Terr Mayer Booke BES, B Arch, M Arch, LEED AP

**THE 3 Rs OF STEEL DESIGN: REDUCE, REUSE, RECYCLE**

The National Works Yard in Vancouver was awarded a LEED™ Silver rating. The height of the east facing atrium lobby was supported by an architecturally exposed structural steel system that used unique Y shaped columns, comprised of plate members, to support and provide character for the three storey energy efficient Vision Wall system.