# "The Shades of Green Buildings"

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***What's up about this "Green Buildings" phenomenon?***

***How did the concept get started?***

***Why has it developed the momentum to get to where it is now?***

***Where is it going from here?***

These are the topics of my paper on the Shades of Green Buildings. As an Architect I have been involved with a few of these projects and I'm getting involved more now as a specification consultant.

How did the idea get started? We have had a recent paper that discussed the issue of Climate Changes and that is part of it. The World Meteorological Organization estimates that 150,000 people died in 2004 from climate-change-driven weather extremes. There are 6.3 billion people living on this planet and by the middle of this century there may be over 9 billion. The levels of carbon in the atmosphere have spiked in recent years. Ninety percent of the large predatory fishes are now gone. Forests are disappearing at record rates. We are at the midpoint of oil extraction while world demand for oil is rising sharply. Worldwide wealth continues to be concentrated on a very small upper echelon of super wealthy, while 2 billion live in conditions of absolute poverty. Currently there is no national or global system of governance adequate to reverse these and related trends in a timely, orderly, and humane manner.

The term, *"sustainability,"* was first defined in 1981 by Lester Brown, a well-known American environmentalist, and for many years the head of the Worldwatch Institute. In his book, "Building a Sustainable Society" he defined a sustainable society as "*…one that is able to satisfy its needs without diminishing the chances of future generations."*

In 1987, the Bruntland Commission, headed by then Prime Minister of Norway, Gro Bruntland, adapted Brown's definition, referring to sustainable development as *"…meeting the needs of the present without compromising the ability of future generations to meet their needs."*

Needless to say, something needs to change. That need for change has been evident for some time. In the early 90's, people began coming together to discuss their concerns about our planet being able to sustain

itself given the impact of all these humans using and abusing it. A book that embraced that concern was authored by Paul Hawken in 1993, entitled, *The Ecology of Commerce*.

Given the impact of this book, I would like to discuss some of the important ideas it illustrates. The title, *The Ecology of Commerce*, is an oxymoron for how wide the gap has become between the natural world and our commercial lives. Business believes that it must continue to grow to survive. Ecologists believe that if business continues this unabated expansion, it will destroy the world around it. Hawken proposes a third path that is inherently sustainable and restorative and continues to use many of the historically effective organizational and market techniques of free enterprise.

Central to his argument are two basic facts; first that the age of industrialism, as we know it, has come to an end; and second that we are confronting a global ecological crisis that is considerably more acute than most of us realize. Business people must dedicate themselves to transforming commerce to a restorative undertaking. We simply have no other choice as we are exceeding the carrying capacity of the planet; *the maximum level of life an ecosystem can sustain.*

Business has three basic issues to address according to Hawken: what it ***takes***, what it ***makes***, and what it ***wastes***. Put another way, the harmful way it exploits natural resources; the excessive amounts of toxins and pollutants it produces and the energy it consumes in the process; and the extraordinary wastes it leaves behind. An ecological model of commerce would imply that all waste has value to other modes of production so that everything is either; ***reclaimed, reused, or recycled***.

According to Hawken, the drive to develop this restorative economy must come from businesses themselves, for *"no other institution in the modern world is powerful enough to foster the necessary changes."* What is needed are not new government bureaucracies or legislative mandates but incentives that will redefine the basis on which companies make decisions; changing it from short-sighted commercial gain to long-view ecological and commercial sustainability.

Hawken's book, The Ecology of Commerce, was read by the early organizers of the U.S. Green Building Council (USGBC) who had their first conference in March of 1994. Paul Hawken was a speaker at that conference. He also spoke in November of that year for the first International Conference on Sustainable Construction in Tampa, Florida. In attendance were people from 35 countries, many being converted by his

writings. Activities were emerging related to sustainability across the country and around the world, remarkably at the same time during the mid 1990's. During that time the American Institute of Architects (AIA) formed the Committee on the Environment (COTE), The U.S. Green Building Council was founded in 1993, the first international green building conferences were held in England and Florida, and work began on developing the first tools for measuring the environmental and resource impact of buildings. The American Society for Testing and Materials (ASTM) initiated work on standards to address green building design and construction, an effort that later evolved into the development of the USGBC's Leadership in Energy and Environmental Design (LEED) building assessment standard.

In 1994, the Conseil International du Batiment (CIB), an international construction research networking organization, defined the goal of sustainable construction as *"…creating and operating a healthy built environment based on resource efficiency and ecological design."* The CIB articulated Seven Principles of Sustainable Construction that would ideally inform decision making during each phase of the design and construction process, continuing throughout the building's entire life cycle. These seven principles are:

1. *Reduce resource consumption (reduce).*
2. *Reuse resources (reuse).*
3. *Use recyclable resources (recycle).*
4. *Protect nature (nature).*
5. *Eliminate toxins (toxics).*
6. *Apply life-cycle costing (economics).*
7. *Focus on quality (quality).*

What is the connection between the commercial and residential building industry and its relationship with sustainability and green design? It is clearly due to the amount of impact these industries have on the environment as expressed in the following statistics from 2005:

- *Consume 65.2% of total US electricity*
- *Use greater than 36% of total US primary energy*
- *Emit 30% of total US greenhouse gases*
- *Produce 136 million tons of construction and demolition waste in the US (approx. 2.8 lbs./person/day)*
- *Use 12% of all the potable water in the US*
- *Use 40% of global raw materials (3 billion tons annually)*

The term *green building* refers to the quality and characteristics of the actual structure created using the principles and methodologies of sustainable construction. Green buildings can be defined as *"healthy facilities designed and built in a resource-efficient manner, using ecologically based principles."*

Green buildings are achieving rapid penetration in the US commercial construction market. These high-performance green buildings unify the best features of conventional construction methods with emerging high-performance approaches such as:

1. *Sustainable construction techniques provide an ethical and practical response to issues of environmental impact and resource consumption.*
2. *Green buildings virtually always make economic sense on a life-cycle cost (LCC) basis, though they may be more expensive on a capital, or first-cost, basis.*
3. *Sustainable design acknowledges the potential effect of the physical structure, including its operation, on the health of its human occupants.*

If people first started talking together about sustainability back in the early to mid 1990's, why has it taken this long to really catch on? Much of this delay is waiting for business to get on board and realize the economic benefits of green building. Those involved were skeptical about three crucial issues:

1. *Whether green buildings could achieve the energy and environmental goals called for under the building rating systems.*
2. *Whether the building products and materials needed to meet those goals would be available, at what cost, and at what quality and performance levels.*
3. *Whether green buildings would cost more to build than comparable "conventional" buildings, and, if so, how much more.*

In recent years, all three of these concerns have largely been put to rest. In regards to the energy goals of the first, more building teams are routinely producing sustainable projects with energy savings in the 20 to 30 percent range compared to industry standards.

Regarding the second concern of availability, there are many and more easily accessible *"environmentally preferable"* products and materials on the market now than just a few years ago. Building product manufacturers have been falling over themselves to come up with green product lines for paints, finishes, carpet, windows, furniture, roofing, glass, plumbing fixtures, lighting, and exterior cladding materials. Building teams can easily specify 90 to 95 percent of the basic green products and materials they need for their jobs, and at prices competitive with conventional products.

That leaves "first cost." Back in 2000, the thinking was building green could cost 20 to 25 percent more than conventional buildings and wreak havoc on project budgets. Research completed the last few years has calmed these fears to a great extent. In late 2003, Greg Kats and others released a study showing the average construction premium across the country for 33 green buildings was 1.84 percent. Later in 2004 research had indicated that the costs were going even lower.

What happened is that the financial sector of the real estate industry, heretofore a casual bystander, suddenly woke up to green building – not necessarily because its members had miraculously developed an insatiable urge to save the planet, but because they had begun to see a viable new investment opportunity. There was a shift in theme for the green building movement, from environmental cause to financial opportunity.

The Architects/Engineers/Contractors (AEC) has also drastically increased their involvement with green building. In a survey completed by Building Design + Construction, respondents to the question of whether their firms are *"somewhat experienced"* or *"very experienced"* in sustainable projects the percentages have increased from a total of 42% in 2003, 49% in 2004, and jumped to 59% in 2006. This dramatic increase in AEC activity in sustainability was underscored by one of the survey respondents who said, *"The green building segment in the built environment is not a passing trend: It is the beginning of a change that will need to occur worldwide."*

What are the Sustainable Building Rating Systems in use in the US and other countries throughout the World? I have provided a copy of a document completed by the Pacific Northwest National Laboratory this past July for the General Services Administration (GSA). It provides a comprehensive listing of the sustainable building rating systems in development or in use throughout the world. It also indicates whether it was an original system or based on another system. Please refer to your handouts.

| Table 1. Rating System Source(s) | |
|---|---|
| **Sustainable Building Rating Systems** | **Development Basis** |
| **BREEAM (Building Research Establishment's Environmental Assessment Method)** | Original |
| BREEAM Canada | BREEAM |
| BREEAM Green Leaf | BREEAM, Green Leaf™ |
| Calabasas LEED | LEED® |
| **CASBEE (Comprehensive Assessment System for Building Environmental Efficiency)** | Original |
| **CEPAS (Comprehensive Environmental Performance Assessment Scheme)** | LEED®, BREEAM, HK-BEAM, IBI |
| **Earth Advantage Commercial Buildings (Oregon)** | Undisclosed |
| **EkoProfile (Norway)** | Undisclosed |
| **ESCALE** | Undisclosed |
| **GBTool** | Original |
| GEM (Global Environmental Method) For Existing Buildings (Green Globes) – UK | Green Globes Canada |
| **GOBAS (Green Olympic Building Assessment System)** | CASBEE, LEED® |
| **Green Building Rating System – Korea** | BREEAM, LEED®, BEPAC |
| Green Globes Canada | BREEAM Green Leaf |
| **Green Globes™ US** | Green Globes Canada |
| **Green Leaf Eco-Rating Program** | Original |
| **Green Star Australia** | BREEAM, LEED® |
| HK BEAM (Hong Kong Building Environmental Assessment Method) | BREEAM |
| **HQE (High Environmental Quality)** | Undisclosed |
| **iDP (Integrated Design Process)** | Original |
| **Labs21** | Original |
| **LEED® (Leadership in Energy and Environmental Design)** | Original |
| LEED Canada | LEED® |
| LEED India | LEED® |
| LEED Mexico | LEED® |
| **MSBG (The State of Minnesota Sustainable Building Guidelines)** | LEED®, Green Building Challenge '98, and BREEAM |
| **NABERS (National Australian Built Environment Rating System)** | Undisclosed |
| **PromisE** | Undisclosed |
| Protocol ITACA | GBTool |
| **SBAT (Sustainable Buildings Assessment Tool)** | Original |
| **Scottsdale's Green Building Program** | Undisclosed |
| SPiRiT (Sustainable Project Rating Tool) | LEED® |
| **TERI Green Rating for Integrated Habitat Assessment** | Original |
| **TQ Building Assessment System (Total Quality Building Assessment System)** | Original |

The rating systems indicated represent more than 30 potentially useful whole building tools or systems. However, most of them did not meet the GSA's basic requirements or were variations of the same system. A description of five of these systems is provided in the handout with a more detailed description of the USGBC's LEED rating system.

## Building Research Establishment's Environmental Assessment Method

## BREEAM

This system has longest track record and was developed in 1990 by the United Kingdom. It is not extensively used in the US. Many sustainable design professionals are aware of BREEAM, and many rating systems started with it as they developed their own system. The rating system results are neither used nor recognized by U.S. design professionals.

When a building is assessed, points are awarded for each criterion and the points are added for a total score. The overall building performance is awarded a "Pass", "Good", "Very Good", or "Excellent" rating based on the total score.

*BREEAM's major categories of criteria for Design and Procurement include the following:*

- **Management** (commissioning, monitoring, waste recycling, pollution minimization, materials minimization)
- **Health & Wellbeing** (adequate ventilation, humidification, lighting, thermal comfort)
- **Energy** (sub-metering, efficiency and CO2 impact of systems)
- **Transport** (emissions, alternate transport facilities)
- **Water** (consumption reduction, metering, leak detection)
- **Materials** (asbestos mitigation, recycling facilities, reuse of structures, façade or materials, use of crushed aggregate and sustainable timber)
- **Land Use** (previously used land, use of remediated contaminated land)
- **Ecology** (land with low ecological value or minimal change in value, maintaining major ecological systems on the land, minimization of biodiversity impacts)
- **Pollution** (leak detection systems, on-site treatment, local or renewable energy sources, light pollution design, avoid use of ozone depleting and global warming substances)

The following figure represents an example of the BREEAM rating system.

## BREEAM Offices 2005 - Design & Procurement Assessment tool

### *Design Stage Assessment Results*

| BREEAM Rating: Example 1 | Good |
|---|---|

**Core & Design & Procurement Credit Allocation Table**

| Overall Credit Allocation | Env Weighting | Available | Achieved | Percentage section credits achieved | Overall Weighted Percentage |
|---|---|---|---|---|---|
| Management | 15% | 10 | 5 | 50.00% | 7.50% |
| Health & Wellbeing | 15% | 15 | 8 | 53.33% | 8.00% |
| Energy | | 17 | 9 | 52.94% | |
| Transport | | 14 | 7 | 50.00% | |
| Energy & Transport | 25% | 31 | 16 | 51.61% | 12.90% |
| Water | 5% | 6 | 4 | 66.67% | 3.33% |
| Materials | 10% | 12 | 4 | 33.33% | 3.33% |
| Land Use & Ecology | 15% | 11 | 6 | 54.55% | 8.18% |
| Pollution | 15% | 12 | 6 | 50.00% | 7.50% |
| | | | | Totals | 50.75% |

BRE BREEAM

## BREEAM Offices 2005 - Design & Procurement Assessment tool

### *Design Stage Assessment Results*

| BREEAM Rating: Example 1 | Good |
|---|---|

| BREEAM Rating | % Benchmark |
|---|---|
| Unclassified | <25 |
| Pass | ≥25 - <40 |
| Good | ≥40 - <55 |
| Very Good | ≥55 - <70 |
| Excellent | ≥70 |

# Comprehensive Assessment System for Building Environmental Efficiency

# CASBEE

CASBEE was developed in Japan, beginning in 2001. This family of assessment tools is based on the building's life cycle: pre-design, new construction, existing building, and renovation. The system requires documentation of quantifiable sustainable design achievements which are assessed by trained, first-class architects that have passed the CASBEE assessor examination. Fewer than 10 buildings have used the system and they are all in Japan. It is relatively unknown in the U.S. market.

CASBEE presents a new concept for assessment that distinguishes environmental load from quality of building performance. By relating these two factors, CASBEE results are presented as a measure of eco-efficiency or BEE (Building Environmental Efficiency). The results are plotted, with environmental load on one axis and quality on the other. The best buildings will fall in the section representing lowest environmental load and highest quality. Each criterion is scored from level 1 up to level 5.

*CASBEE major categories of criteria include the following:*

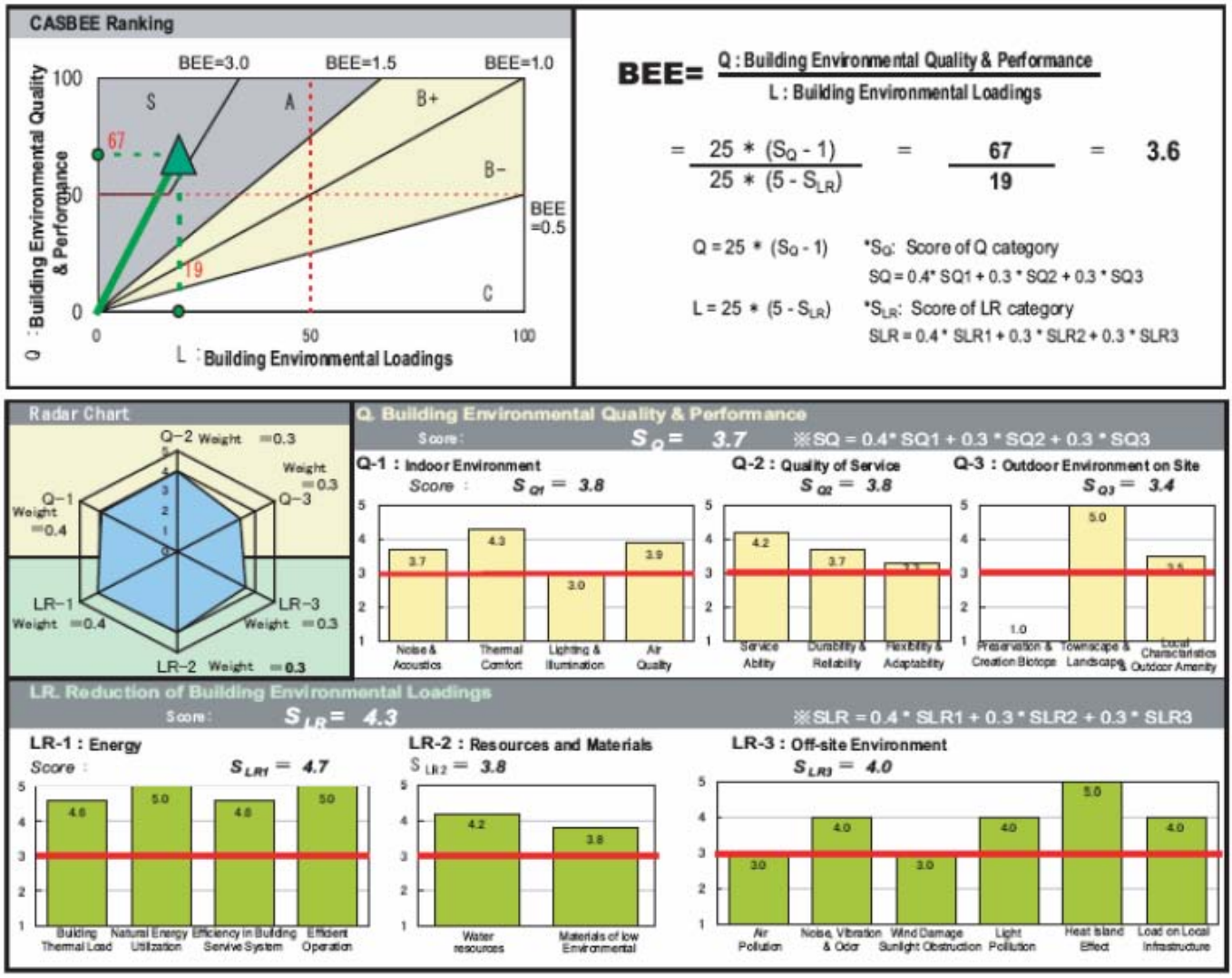
Building Environmental Quality and Performance

- **Indoor Environment** (noise and acoustics, thermal comfort, lighting and illumination, and air quality)
- **Quality of Services** (functionality and usability, amenities, durability and reliability, flexibility and adaptability)
- **Outdoor Environment on Site** (preservation and creation of biotope, townscape and landscape, and outdoor amenities)

Building Environmental Loadings

- **Energy** (thermal load, use of natural energy, efficiency of systems, and efficient operations)
- **Resources and Materials** (water conservation, recycled materials, sustainably harvested timber, materials with low health risks, reuse and reusability, and avoidance of CFC's and halons)
- **Off-site Environment** (air pollution, noise and vibration, odor, sunlight obstruction, light pollution, heat island effect, and local infrastructure)

The following figure represents an example of the CASBEE rating system:



# GBTool

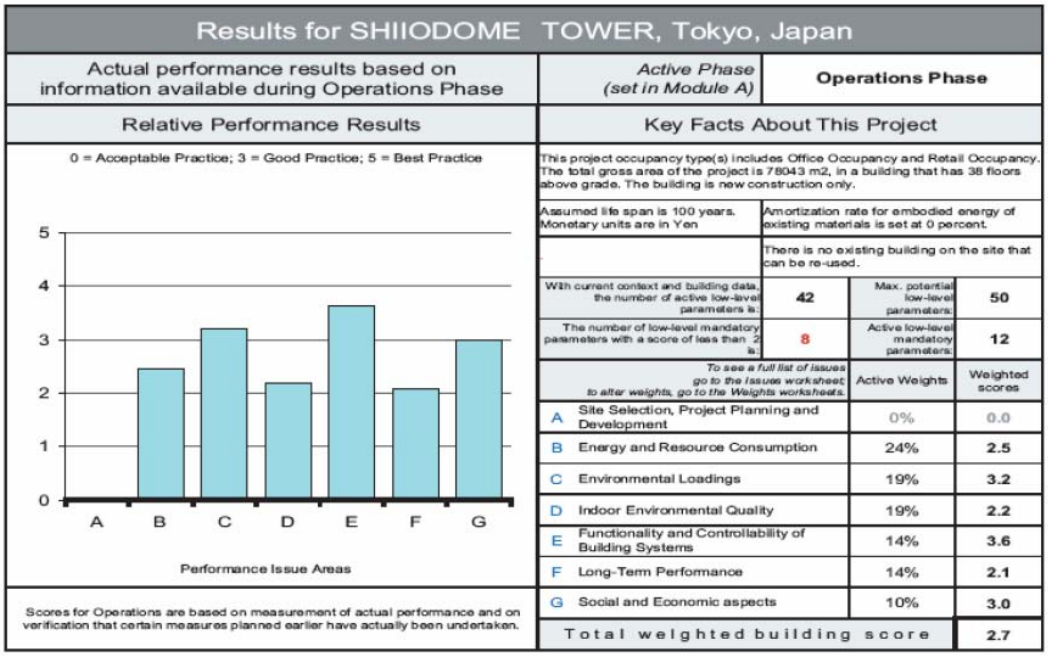
GBTool was developed by the International Framework Committee for the Green Building Challenge, an international project that has involved more than 25 countries since 1998. Criteria are assessed using scales that are based on local benchmarks of "typical" practice; buildings can score (-1) if below typical practice or from (+1) to (+5), representing good to very high performance. All criteria must be scored, thus providing a complete assessment of the building.

Due to the flexibility inherent in the application of GBTool, it tends to require greater technical expertise to implement than other rating systems; this has limited its exposure in the U.S. market.

*GBTool major categories of criteria include the following:*

- **Site Selection** (land use, brownfields, access to transportation and amenities)
- **Project Planning and Development** (urban design; density, mixed use, compatibility, native plantings, and wildlife corridors)
- **Energy Consumption** (total use of non-renewable energy [embodied and operational], electrical peak demand for operations, use of renewable energy, and commissioning)
- **Resource Consumption** (material use [salvaged, recycled, bio-based and sustainably harvested, locally produced, designed for disassembly, re-use, or recycling], and water use for irrigation, building systems, and occupant use)
- **Environmental Loadings** (greenhouse gas emissions, other atmospheric emissions, solid wastes, stormwater, wastewater, sit impacts, and other local and regional impacts)
- **Indoor Environmental Quality** (indoor air quality, ventilation, temperature and relative humidity, daylight and illumination, and noise and acoustics)
- **Functionality and Controllability of Building Systems** (building controls, flexibility and adaptability)
- **Long-Term Performance**
- **Social and Economic Aspects**

The following figure represents an example of the CBTool rating system:



# Green Globes US

Green Globes US was adapted from the Green Globes Canada rating system in 2004. Green Globes Canada was developed as a web-based version of both *BREEAM Canada* and *Green Leaf.* It is funded by The Green Building Initiative and is an on-line tool designed for use by architects and builders for any size commercial building. Green Globes allows users to evaluate their building systems based on the amount of applicable available points, having the option of indicating as "not applicable" in some categories. Projects that are third-party verified and have achieved over 35 percent of the points can earn a rating of 1 to 4 Green Globes. *[85 to 100% = 4; 70 – 84% = 3; 55 – 69% = 2; 35 – 54% = 1 Green Globe]*

The Green Building Initiative received accreditation as a standards developer by the American National Standards Institute (ANSI) and is working toward developing Green Globes U.S. as an official ANSI standard. Currently, sustainable design and construction information is submitted on-line for third party verification that is provided by a Green Building Initiative-approved and Green Globes trained professionals. Although there has been much publicity around Green Globes U.S. in recent years, only four buildings in the U.S. have received Green Globes ratings and 63 buildings have registered and may pursue verification in the future, that number is much higher in Canada and in other countries.

*Green Globes US major categories of criteria include the following:*

- **Project Management** (integrated design, environmental purchasing, commissioning, emergency response plan)
- **Site** (site development area, reduce ecological impacts, enhancement of watershed features, site ecology improvement)
- **Energy** (energy consumption, energy demand minimization, "right sized" energy efficient systems, renewable sources of energy, energy-efficient transportation)
- **Water** (flow and flush fixtures, water-conserving features, reduce off-site treatment of water)
- **Indoor Environment** (effective ventilation systems, source control of indoor pollutants, lighting design and integration of lighting systems, thermal comfort, acoustic comfort)
- **Resource, Building Materials and Solid Waste** (materials with low environmental impact, minimized consumption and depletion of material resources, re-use of existing structures; building durability, adaptability and disassembly; and reduction, re-use and recycling of waste)

The following figures represent an example of the Green Globes US rating system:

# **The** Green Globes Design **Points System**

| Percentage Score | Points Score | Areas and Sub-Areas of Assessment |
|---|---|---|
| **5%** | **50** | **A - Project Management** |
| | 20 | A.1 - Integrated design process |
| | 10 | A.2 - Environmental purchasing (including energy efficient products) |
| | 15 | A.3 - Commissioning |
| | 5 | A.4 - Emergency response plan |
| **11.5%** | **115** | **B - Site** |
| | 30 | B.1 - Development area (site selection, development density, site remediation) |
| | 30 | B.2 - Ecological impacts (native planting and vegetation, heat islands, night sky) |
| | 20 | B.3 - Watershed features (site grading, stormwater management, pervious cover, rainwater capture) |
| | 35 | B.4 - Site ecology enhancement |
| **38%** | **380** | **C - Energy** |
| | 100 | C.1 - Energy performance |
| | 114 | C.2 - Reduced energy demand (space optimization, microclimatic response to site, day-lighting, envelope design, metering) |
| | 66 | C.3 - Integration of energy efficient systems |
| | 20 | C.4 - Renewable energy sources (on-site renewable energy technologies) |
| | 80 | C.5 - Energy-efficient transportation (public transportation, cycling facilities) |
| **8.5%** | **85** | **D - Water** |
| | 30 | D.1 - Water performance |
| | 45 | D.2 - Water conserving features (sub-metering, devices, cooling towers, landscaping and irrigation strategies) |
| | 10 | D.3 - On-site treatment of water (greywater system, on-site wastewater treatment) |
| **10%** | **100** | **E - Resources** |
| | 40 | E.1 - Low impact systems and materials (selection of building materials based on the low environmental impact) |
| | 15 | E.2 - Minimal consumption of resources (reused, recycled, local, low-maintenance materials, certified wood) |
| | 15 | E.3 - Reuse of existing buildings |
| | 15 | E.4 - Building durability, adaptability and disassembly |
| | 5 | E.6 - Reduction, reuse and recycling of demolition waste |
| | 10 | E.7 - Recycling and composting facilities |
| **7%** | **70** | **F - Emissions, Effluents & Other Impacts** |
| | 15 | F.1 - Air emissions (low emission burners) |
| | 20 | F.2 - Ozone depletion |
| | 10 | F.3 - Avoiding sewer and waterway contamination |
| | 25 | F.4 - Pollution minimization (storage tanks, PCBs, radon, asbestos, pest management, hazardous materials) |
| **20%** | **200** | **G - Indoor Environment** |
| | 55 | G.1 - Ventilation system (intakes, ventilation rates, delivery, $CO_2$ monitoring, controls, parking areas, ease of maintenance) |
| | 45 | G.2 - Control of indoor pollutants (mould, AHU, humidification, Legionella cooling towers/ hot water, building materials, local exhaust) |
| | 50 | G.3 - Lighting (visual access, heights & depths of perimeter spaces, daylight factor, ballasts, glare, task lighting, controls) |
| | 20 | G.4 - Thermal comfort (thermal conditions meet ASHRAE 55) |
| | 20 | G.5 - Acoustic comfort (zoning, transmission, vibration control, acoustic privacy, reverberation, mechanical noise) |
| **100%** | **1000** | **TOTAL POINTS AVAILABLE** |

# Leadership in Energy and Environmental Design

## LEED

The Green Building movement in the US has been defined by the dominant position of the USGBC's LEED building assessment standards. A considerable amount of work was accomplished from 1993 when USGBC was first organized to 1998 when the first building assessment tool became available. LEED provides a tool to rate a building's *"greenness"* as well as guiding building design. Since 1998, it has doubled in size each year by several measures, such as membership and floor area of buildings certified under LEED. This enormous success has brought on a number of problems. The USGBC is struggling to keep up with the large number of building registrations and consequent paperwork and documentation needed to maintain its integrity. There are currently a suite of five products, all needing to be synchronized with a core philosophy and relatively standard approach.

LEED-NC (for New Construction and Renovations/Additions), was the first system made available and is clearly the dominate product. LEED-NC has four levels of certification based on the number of points earned in the integrated design and construction process. A maximum of 69 points are available.

- *Certified Level: 26 – 32 points*
- *Silver Level: 33 – 38 points*
- *Gold Level: 39 – 51 points*
- *Platinum Level: 52+ points*

In addition to LEED-NC, there are versions for existing buildings (LEED-EB), commercial interiors (LEED-CI), core and shell (LEED-CS), homes (LEED-H), and neighborhood development (LEED-ND). There are also application guides that can be used to increase the applicability and flexibility of LEED for multiple buildings and campuses, schools, health care, laboratories, lodging, and a pilot program for retail.

Documentation of the quantifiable sustainable design measures are provided to the USGBC, for third-party verification. The assessors have been trained and must pass an assessor examination thus becoming LEED-AP (Accredited Professional).

*LEED's major categories of criteria include the following:*

- **Sustainable Sites** (construction related pollution prevention, site development impacts, transportation alternatives, stormwater management, heat island effect, and light pollution)
- **Water Efficiency** (landscaping water use reduction, indoor water use reduction, and wastewater strategies)
- **Energy and Atmosphere** (commissioning, whole building energy performance optimization, refrigerant management, renewable energy use, and measurement and verification)
- **Materials and Resources** (recycling collection locations, building reuse, construction waste management, and the purchase of regionally manufactured materials, materials with recycled content, rapidly renewable materials, salvaged materials, and sustainably forested wood products)
- **Indoor Environmental Quality** (environmental tobacco smoke control, outdoor air delivery monitoring, increased ventilation, construction indoor air quality, use low emitting materials, source control, and controllability of thermal and lighting systems)
- **Innovation and Design Process** (LEED accredited professional, and innovative strategies for sustainable design)

The following figure represents an example of the LEED rating system:

**SSA Child Care Center, LEED Project # 0265**
**LEED Version 2.0 Certification Level: CERTIFIED**
**Feb. 27, 2003**

**28 Points Achieved** — Possible Points: 69

Certified 26 to 32 points  Silver 33 to 38 points  Gold 39 to 51 points  Platinum 52 or more points

**6 Sustainable Sites** — Possible Points: 14

| Y | | | |
|---|---|---|---|
| Y | Prereq 1 | Erosion & Sedimentation Control | |
| 1 | Credit 1 | Site Selection | 1 |
| | Credit 2 | Urban Redevelopment | 1 |
| | Credit 3 | Brownfield Redevelopment | 1 |
| 1 | Credit 4.1 | Alternative Transportation, Public Transportation Access | 1 |
| | Credit 4.2 | Alternative Transportation, Bicycle Storage & Changing Rooms | 1 |
| | Credit 4.3 | Alternative Transportation, Alternative Fuel Refueling Stations | 1 |
| | Credit 4.4 | Alternative Transportation, Parking Capacity | 1 |
| 1 | Credit 5.1 | Reduced Site Disturbance, Protect or Restore Open Space | 1 |
| 1 | Credit 5.2 | Reduced Site Disturbance, Development Footprint | 1 |
| 1 | Credit 6.1 | Stormwater Management, Rate and Quantity | 1 |
| | Credit 6.2 | Stormwater Management, Treatment | 1 |
| | Credit 7.1 | Landscape & Exterior Design to Reduce Heat Islands, Non-Roof | 1 |
| | Credit 7.2 | Landscape & Exterior Design to Reduce Heat Islands, Roof | 1 |
| 1 | Credit 8 | Light Pollution Reduction | 1 |

**2 Water Efficiency** — Possible Points: 5

| Y | | | |
|---|---|---|---|
| 1 | Credit 1.1 | Water Efficient Landscaping, Reduce by 50% | 1 |
| 1 | Credit 1.2 | Water Efficient Landscaping, No Potable Use or No Irrigation | 1 |
| | Credit 2 | Innovative Wastewater Technologies | 1 |
| | Credit 3.1 | Water Use Reduction, 20% Reduction | 1 |
| | Credit 3.2 | Water Use Reduction, 30% Reduction | 1 |

**5 Energy & Atmosphere** — Possible Points: 17

| Y | | | |
|---|---|---|---|
| Y | Prereq 1 | Fundamental Building Systems Commissioning | |
| Y | Prereq 2 | Minimum Energy Performance | |
| Y | Prereq 3 | CFC Reduction in HVAC&R Equipment | |
| 2 | Credit 1.1 | Optimize Energy Performance, 20% New / 10% Existing | 2 |
| 2 | Credit 1.2 | Optimize Energy Performance, 30% New / 20% Existing | 2 |
| 1 | Credit 1.3 | Optimize Energy Performance, 40% New / 30% Existing | 2 |
| | Credit 1.4 | Optimize Energy Performance, 50% New / 40% Existing | 2 |
| | Credit 1.5 | Optimize Energy Performance, 60% New / 50% Existing | 2 |
| | Credit 2.1 | Renewable Energy, 5% | 1 |
| | Credit 2.2 | Renewable Energy, 10% | 1 |
| | Credit 2.3 | Renewable Energy, 20% | 1 |
| | Credit 3 | Additional Commissioning | 1 |
| | Credit 4 | Ozone Depletion | 1 |
| | Credit 5 | Measurement & Verification | 1 |
| | Credit 6 | Green Power | 1 |

**6 Materials & Resources** — Possible Points: 13

| Y | | | |
|---|---|---|---|
| Y | Prereq 1 | Storage & Collection of Recyclables | |
| | Credit 1.1 | Building Reuse, Maintain 75% of Existing Shell | 1 |
| | Credit 1.2 | Building Reuse, Maintain 100% of Existing Shell | 1 |
| | Credit 1.3 | Building Reuse, Maintain 100% Shell & 50% Non-Shell | 1 |
| 1 | Credit 2.1 | Construction Waste Management, Divert 50% | 1 |
| 1 | Credit 2.2 | Construction Waste Management, Divert 75% | 1 |
| | Credit 3.1 | Resource Reuse, Specify 5% | 1 |
| | Credit 3.2 | Resource Reuse, Specify 10% | 1 |
| 1 | Credit 4.1 | Recycled Content, Specify 25% | 1 |
| 1 | Credit 4.2 | Recycled Content, Specify 50% | 1 |
| 1 | Credit 5.1 | Local/Regional Materials, 20% Manufactured Locally | 1 |
| 1 | Credit 5.2 | Local/Regional Materials, of 20% Above, 50% Harvested Locally | 1 |
| | Credit 6 | Rapidly Renewable Materials | 1 |
| | Credit 7 | Certified Wood | 1 |

**7 Indoor Environmental Quality** — Possible Points: 15

| Y | | | |
|---|---|---|---|
| Y | Prereq 1 | Minimum IAQ Performance | |
| Y | Prereq 2 | Environmental Tobacco Smoke (ETS) Control | |
| | Credit 1 | Carbon Dioxide ($CO_2$) Monitoring | 1 |
| | Credit 2 | Increase Ventilation Effectiveness | 1 |
| | Credit 3.1 | Construction IAQ Management Plan, During Construction | 1 |
| 1 | Credit 3.2 | Construction IAQ Management Plan, Before Occupancy | 1 |
| 1 | Credit 4.1 | Low-Emitting Materials, Adhesives & Sealants | 1 |
| | Credit 4.2 | Low-Emitting Materials, Paints | 1 |
| 1 | Credit 4.3 | Low-Emitting Materials, Carpet | 1 |
| | Credit 4.4 | Low-Emitting Materials, Composite Wood | 1 |
| 1 | Credit 5 | Indoor Chemical & Pollutant Source Control | 1 |
| | Credit 6.1 | Controllability of Systems, Perimeter | 1 |
| | Credit 6.2 | Controllability of Systems, Non-Perimeter | 1 |
| 1 | Credit 7.1 | Thermal Comfort, Comply with ASHRAE 55-1992 | 1 |
| 1 | Credit 7.2 | Thermal Comfort, Permanent Monitoring System | 1 |
| | Credit 8.1 | Daylight & Views, Daylight 75% of Spaces | 1 |
| 1 | Credit 8.2 | Daylight & Views, Views for 90% of Spaces | 1 |

**2 Innovation & Design Process** — Possible Points: 5

| Y | | | |
|---|---|---|---|
| 1 | Credit 1.1 | Innovation in Design: Exemplary Performance 38% Local Materials | 1 |
| | Credit 1.2 | Innovation in Design: | 1 |
| | Credit 1.3 | Innovation in Design: | 1 |
| | Credit 1.4 | Innovation in Design: | 1 |
| 1 | Credit 2 | LEED™ Accredited Professional | 1 |

There are more than 400 U.S. buildings that have received LEED ratings and more than 3400 buildings are registered and therefore potentially seeking certification. LEED is not only the U.S. market leader, but is also the most widely used rating system by Federal and state agencies, which makes it easy to communicate a building's sustainable design achievements with others.

The market for the LEED NC assessment is largest on the west coast. As of October 2005, California has 358 registered projects, New York and Washington are next with 125 each, Oregon is at 103, and Michigan is seventh with 86.

*Western Michigan has a list of LEED projects primarily in Grand Rapids with a few here in Holland. There are also others on the east side of the state. Refer to the following list:*

| **Holland** | **Rating** |
|---|---|
| o West Ottawa Public Schools; New High School | Certified |
| o Herman Miller Front Door Renovation | Gold |
| o Herman Miller C1 Site | Gold |
| o Herman Miller Greenhouse | LEED Pioneer Award |
| o Herman Miller Marketplace | Gold |

| **Grand Rapids** | **Rating** |
|---|---|
| o Goodwillie Environmental School | Certified |
| o Forest Hills Public Schools New Secondary School | Certified |
| o FHPS – Fine Arts Center | Silver |
| o FHPS – Knapp Forest Elementary | Certified |
| o Bazzani Associates Headquarters | Silver |
| o Richard J. Lacks, Sr. Cancer Center; St. Mary's Mercy | Certified |
| o City of GR; Water/Environmental Services Facility | Certified |
| o Interurban Transit Partnership (Rapid Central Station) | Certified |
| o Calvin College Bunker Interpretive Center | Gold |
| o BCBSM/Steketees Building | Certified |
| o Grand Rapids Metropolitan YMCA | Certified |
| o East Hills Center of the Universe | Gold |
| o West Michigan Environmental Action Council | Gold |
| o Keystone Community Church | Certified |
| o Sylvan Learning Center | Certified |
| o GVSU – Lake Ontario Hall | Certified |
| o Steelcase Wood Furniture Manufacturing Plant | Silver |

| **Detroit** | **Rating** |
|---|---|
| o Detroit Lions HQ & Training Facility | Certified |
| o Fairlane Green Phase 1 | Gold |
| o Detroit School of Arts | Certified |
| o Ford Rouge Visitor Center | Gold |

| **Ann Arbor** | **Rating** |
|---|---|
| o S. T. Dana Building Renovations | Gold |

| **Lansing** | **Rating** |
|---|---|
| o General Motors Assembly Plant | Certified |

## Calvin College Bunker Interpretive Center

*1750 East Beltline Ave SE, Grand Rapids*

A part of the Calvin College campus, the Bunker Interpretive Center is approximately 5,000 square feet of green building. The structure is used as home base for select formal programs, a study center, and an educational resource for visitors. Dedicated in September of 2004, the Center earned gold rating from the U.S. Green Building Council in May 2005. The building is built on a 90-acre ecosystem preserve and boasts a photovoltaic power system that supplies 60% of the building's annual electricity needs. Other green features include a radiant heating system in the floor, a gray water treatment system, passive lighting, automated passive cooling, native landscaping, and composting toilets.

## City of Grand Rapids- Water/Environmental Services Facility

*1900 Oak Industrial Drive NE, Grand Rapids*

Ground was broken in May 2003 and on March 1, 2004, the doors were opened for day to day operations. The Water/Environmental Services building became the first municipally owned LEED certified building in Michigan. Employees gained the benefits of natural light and views, no dangerous off-gassing from building materials, a clean air handling system, thermal comfort and various other items.


## David D. Hunting YMCA

*475 Lake Michigan Drive, Grand Rapids*

The 159,000 square foot David D. Hunting YMCA is the largest urban YMCA in the nation. It is a LEED certified building, with notable green features such as low-VOC interior finishes and flooring, photovoltaic panels, arched footprint and glass curtain walls for passive heating/cooling. Many materials have a high recycled content (such as the ceiling tile and insulation), the gym floor was manufactured using sustainably harvested trees and the site is landscaped with native vegetation and a bioswale. The building also features water-free urinals low-e glass, and cork tile. Completed in July 2005.

## Detroit Lions Headquarters and Training Facility

*222 Republic Drive, Allen Park, MI*

The franchise broke ground in August 2000 and completed the $35.5 million building in March 2002. The 460,000 square foot complex features bamboo flooring (a rapidly renewable resource), rubber flooring, motion sensor lights, low VOC carpets and paints, and a playing field made from FieldTurf (sand and recycled rubber infill between blades of soft polyethylene & polypropylene fibers). The building obtained basic LEED certification.

## Detroit School of Arts

*123 Seldon, Detroit, MI*

Completed in February 2005, the Detroit School of Arts is a 1200 student, 286,219 square foot high school that is part of the Detroit Public Schools. The six story structure represents a combination of the Communications and Media High School with the Detroit School for Performing Arts. The green building houses an 800 seat auditorium, 200 seat recital hall, black box theater, television and radio production studios, art galleries and studios, and music rehearsal rooms. Sustainable building features include highly reflective roofing material, trees for shade, and a properly oriented building (extending east to west) to help reduce energy costs. Natural daylighting, a 3,954 square foot green roof, and energy-efficient windows also helped achieve a basic LEED rating.


## East Hills Center (of the Universe)

*1001-1009 Lake Dr. SE, Grand Rapids, MI*

Also known locally as the *Center of the Universe*, the East Hills Center represents a successful brownfield redevelopment project in Grand Rapids, Michigan. Previously an abandoned Shell Oil Station at the corner of Lake and Diamond, the site now is home to a bustling commercial building thanks to the foresight of Guy Bazzani of Bazzani Associates. The building earned Gold LEED certification (LEED CS, v1.0) due to green features like a vegetated roof, a rain garden, exterior and primary interior built from Eco-Block Insulating Concrete Forms (ICFs), high fly-ash concrete, light shelves, movable interior walls, a raised access floor, PLA carpet tiles, and no or low-VOC paint and motion sensors.


## First National Bank in Howell – Green Oak Township Office

*9775 M-36, Whitmore Lake, MI*

The First National Bank in Howell partnered with A3C Collaborative Architecture in the design of the new building. The owners expected green features to result in energy and water usage savings of nearly 50% each. First National Bank is the first bank in Michigan to be LEED certified and is the second smallest building and only one of two banks in the country to receive the certification. Building features include wood from sustainably managed forests, cellulose insulation from recycled newspaper, and ceramic tile made from recycled glass.

## Ford Rouge Visitor Center

*3001 Miller Road, Dearborn, MI*

The Ford Rouge Visitor Center, adjacent to Dearborn truck plant, earned Gold LEED certification for its sustainable design and construction. This 30,000-square foot facility features a rainwater collection system that allows the use of rainwater for on-site irrigation and toilets. Other green features include vertical landscaping on the side of the structure and a solar array of photo sensory cells to capture sunlight and convert it to electricity. The Visitor Center has an observation deck to overlook the Ford plant. Ford Motor Company incorporated a 454,000-square foot green roof into the greening of the plant in 1999. The roof, is the largest green roof in the world, features sedum that can absorb 4 million gallons of rainwater annually.

## Forest Hills Fine Arts Center

*600 Forest Hill Avenue SE, Grand Rapids, MI*

Designed by Integrated Architecture, the Forest Hills Fine Arts Center is the first public facility of its type to receive a LEED certification in the U.S. The 62,000 square foot Fine Arts Center was completed in 2003 and many green features were built into the design. Steel, concrete, and glass containing recycled content were incorporated into the building shell and more than half of the wood products were harvested sustainably. Low-VOC adhesives, sealants, paints, and carpets were used in the construction, in addition to low-flow water fixtures and waterless urinals. The airflow in the auditorium comes from the floor (instead of the ceiling as in traditional buildings) to save energy and create a more comfortable environment.

## General Motors Lansing Delta Township Assembly Plant

*920 Townsend, Lansing, MI*

This 2 million square foot building began its construction in June 2001 and is now expecting to save over 40 million gallons of water and 30 kwh of electricity over the next ten years. Its environmental highlights include rainwater collection for use in toilets, waterless urinals, and avoiding the use of ozone-depleting substances for energy purposes. The building earned a LEED Gold rating.

## Goodwillie Environmental School

*8400 Two Mile Road, Ada, MI*

The Goodwillie Environmental School, part of the Forest Hills School System, was designed by Progressive AE and built by Triangle Associates. Green features of the school include window overhangs (to maximize winter and minimize summer sun exposure), a passive cooling tower, and a water-source geothermal heat pump system. The structure also boasts high efficiency windows, cellulose wall insulation, low-VOC paint, rubber flooring made of 100% post-consumer recycled car tires and 75% recycled post-industrial HDPE plastic bathroom partitions. The site also features native landscaping and a composite wood deck made from recycled milk jugs and sawdust. These green features earned the building a LEED certified rating.

## GVSU – Lake Ontario Hall

*1 Campus Drive, Allendale, MI*

The newest building on GVSU's Allendale Campus is Lake Ontario Hall, an academic building which houses faculty offices, several student organizations, study areas and specialized classrooms. The building is 55,000 sq. ft. and cost $12 million. A few of the green features include controlled storm water runoff, maximized day lighting, motion and heat sensors, waterless urinals and an energy star compliant roofing system. The building is also near a bus service, interior and exterior lighting were selected to minimize light pollution and outside views are numerous. Many of the materials used in the building were recycled and more than 80 percent of the construction waste generated was recycled. The building achieved Silver LEED Certification

## Harborside Office Center

*1411 3rd Street, Port Huron, MI*

The Harborside Office Center is part of a larger (77-acre) Brownfield redevelopment project along the St. Clair River called Desmond Landing. The 110,000 square foot, four-story tenant office building has a steel frame with brick facade at grade and glass curtain wall at the upper stories. SEMCO Energy, Precision Computers, and Citizens First Bank Data Center are tenants in the structure. The project earned a silver LEED Certification. Designed by Albert Kahn and constructed by Clark Construction Company.

## Herman Miller Greenhouse

*10201 Adams St., Holland, MI*

Designed by William McDonough, the 295,000 square-foot GreenHouse contains a Herman Miller factory and offices. Building materials like operable windows and concrete blocks were used to reduce the structure's heating load. The structure only produces an average of 16 pounds of landfill waste per day, as 97% of solid waste is recycled! The site boasts native grasses, woods, meadows, ponds, and wetlands for employee enjoyment and environmental benefits. The green building features resulted in an 18% decrease in electricity costs and a 65% cut in water/sewer costs, compared to the previous building. Completed in 1995, the U.S. Green Building Council awarded the GreenHouse the LEED Pioneer Award, recognizing the structure as a model of what was possible under the LEED rating system

## Herman Miller Marketplace

*8460 Homestead Dr., Holland, MI*

The 95,000 square foot, two story office building was completed in January 2002, and designed by Integrated Architecture. Green site features include a shaded parking lot, open space, and native landscaping. The Marketplace features low-flow toilets, automatic faucet controls, high-performance (operable) windows and doors, linoleum flooring from linseed oil, and lots of natural daylighting facilitated by an atrium, 12-foot exterior windows, and high ceilings. The building earned a gold LEED certification.

## Rapid Central Station – Interurban Transit Partnership

*250 Grandville Ave SW, Grand Rapids, MI*

Completed in June 2004, the $22.7 million Rapid Central station is an amazing spectacle. It was designed by Progressive AE and obtained a basic LEED rating, making it the first U.S. transportation facility to receive LEED certification. The 51,000 square foot station was built on a reclaimed brownfield site and features an extensive 4,160 square foot green roof system, an undulating roof structure inspired by the Grand River rapids, bands of low-E glass, and floors made from recycled glass aggregates. The station contains bays for 17 buses, community rooms, ticket sales offices, restrooms, a police sub-station, security, concessions and seating areas.