

# Polished Concrete

# & LEED Certification

**A guide to LEED Certification and Polished Concrete**

Exclusively from L&M Construction Chemicals

**FGS**

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**PermaShine**  
The new face of polished concrete



"...one of the newest, greenest, and most affordable flooring options available."  
—BuildingGreen



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**Credits:**

**FGS/PermaShine Polished Concrete Floor Process**

Prepared for L&M Construction Chemicals, May 2007

Commissioned by Greg Schwietz, President

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## Section 1: Background and Purpose

Building teams throughout North America are realizing a rapid movement toward green building. New design strategies and an increasing use of more sustainable products will be required to support this movement. Such effort will maximize points toward the voluntary LEED (Leadership in Energy and Environmental Design) certified building projects. It will also result in compliance with new national sustainability standards and updated local building and energy codes. Because of this reality, L&M Construction Chemicals commissioned Paul Natcher CSI CDT of Green Apple Group, LLC to investigate the possible LEED credits available to building teams when a polished concrete floor is included in

- 1) the design and construction of new buildings, and
- 2) renovations to existing buildings.

Sustainable, "green" or high performance building design strategies are desirable. They can cut long-term energy needs and improve indoor environment quality. They also serve to reduce the overall environmental impact of a building. Many building owners and communities believe that it is proper and environmentally responsible to build facilities which have a minimum impact on our earth's resources. Green building is one of the ways they attempt to fulfill that mandate. For example, carbon dioxide emissions generated from the burning of fossil fuels are considered by many to be one of the largest contributors to global climate change, a contribution that humans can and should control in the coming years. A green building can lessen the structure's reliance on electricity generated by burning coal or other fossil fuels.

Multi-story commercial buildings represent a third of all primary energy use in the United States. They also account for two-thirds of the country's electricity consumption. According to the US Green Building Council, the building sector is responsible for nearly half of all carbon dioxide emissions. Therefore, there have been ongoing efforts to reduce the impact that these buildings have on the environment through the reduction of their energy needs.

Still, there are more than just environmental reasons to build green. From an economic standpoint, the U.S. Environmental Protection Agency (EPA) estimates that tenants or building owners can save about 50 cents per square-foot through strategies that cut energy use by 30 percent. This can represent a savings of \$50,000 or more in the five-year operational costs on 20,000 square feet.

Of the many possible green design strategies, this paper specifically addresses the role of a polished concrete flooring system in a green (sometimes called "high performance") building. Polished concrete





**Section 1:  
Background  
and Purpose  
(continued)**

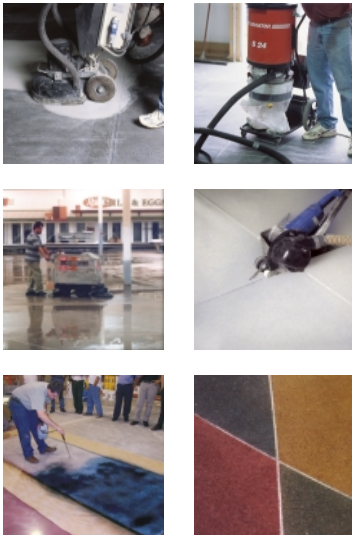
flooring such as FGS/PermaShine is an economical and aesthetically pleasing element within a building team's overall design strategy. Concrete surface treatment for floors is growing in popularity because these floor systems have many sustainable attributes. Therefore, an additional purpose of this white paper is to assist architects, specifiers and design teams who want to maintain aesthetics and safety within a building's interior design with the use of polished concrete while pursuing LEED Green Building Rating System points toward certification.

Finally, this paper also seeks to provide a brief description of the green building movement from its modern day roots to its impact on the future of building design and construction.

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**Section 2:  
Polished Concrete  
Flooring's Role in  
LEED Certified  
Projects**

In general terms, building teams can gain points toward LEED certification from the U.S. Green Building Council for a building project with concrete floor systems. Due to new advances in concrete surface treatments, including the latest patented application method from L&M Construction Chemicals, these polished concrete floors are a cost-effective alternative to terrazzo, vinyl, carpet, tile and other floor surface finishes.



LEED does not assign points for a product. However, the documentation below provides detailed information for building teams that want to use Polished Concrete Floors and are pursuing LEED certification of a building project through LEED for New Construction and Major Renovations, Version 2.2, U.S. Green Building Rating System. The major benefits to pursuing LEED with concrete floor systems are:

- 1) Improved thermal energy mass,
- 2) The potential for reuse of existing building materials, and/or
- 3) Inclusion of post-consumer and post-industrial recycled materials.



"...one of the newest, **greenest**,  
and most affordable flooring  
options available."  
—**BuildingGreen**



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### **Section 3: Other Green Building Rating Systems**

There are more sustainability or building performance rating systems one might consider in addition to LEED. However, LEED for New Construction (LEED-NC), as an initiative of the US Green Building Council, was considered the first U.S. system for rating the sustainability of a new commercial building (mainly offices) it is considered to be the current benchmark. Other rating systems are listed below, but are otherwise beyond the scope of this paper. Please note that other rating systems and energy codes will typically provide points toward compliance with the LEED Rating System for buildings with polished concrete floors. In general, if points are applicable in LEED, they are usually available in other rating systems.

For informational purposes, here is a partial list of sustainable building rating systems:

- **Energy Star** – U.S. Department of Energy program for products and buildings
- **BREEM** – English and Canadian green building rating systems, which pre-dated LEED
- **SPIRIT** – U.S. Air Force sustainability standards
- **Minergy** - Swiss government standard for energy efficiency in buildings
- **CHPS** - California Collaborative for High Performance Schools
- **Go Green** – Building Owners & Managers Association (BOMA)

The only other U.S. national green building ranking system directly comparable to LEED-NC is from the Green Building Initiative (GBI), which awards Green Globes to certified buildings. However, the USGBC historically has brought together more building industry stakeholders for a consensus on what constitutes a green building.

For the first six years following the introduction of LEED, USGBC limited participation of building materials trade groups. It was this practice that some industry experts contend helped to inspire the Green Globes from GBI, which was launched by trade groups representing manufacturers of building products. Today, some within the design community believe the “preferred products list” within the Green Globes (and the DOE's Energy Star) green building rating systems positions it ahead of the LEED rating system, at least from a product manufacturer's standpoint.

Regardless, building teams seeking LEED points toward certification for their design strategies should consider the manufacturing process, materials and installation process of the specified building materials. In fact, the USGBC is promising future versions of the rating system will include Life Cycle Analysis and Embodied Energy of building products such as Polished Concrete Floor Systems to address this criticism of LEED.

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## Section 4: A patented dry grinding and polishing process



“Newly patented advances in dry polished concrete eliminate primitive wet grinding slurry byproducts that typically required landfill disposal.”

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## Section 5: USGBC and the LEED Green Building Rating System



The most environmentally advanced Polished Concrete Floor Systems (MasterFormat Section 033500 Concrete Finishing, and/or 030130 Maintenance of Cast in Place Concrete) currently available include the dry or mechanical grinding method of installation. This patented process, offered by L&M Construction Chemicals under the brand name FGS/PermaShine, is for concrete floor or concrete surface restoration.

Dry polishing is completed through the mechanical grinding of a concrete surface. It continues with the extracting and retaining of the dust during the grinding process. This dry grinding process differs from earlier introduced polished concrete floor systems. Earlier systems mimic classic terrazzo grinding techniques. They require heavy water use during the grinding process, repeated coats of a chemical densifier, and end up producing a wet concrete slurry. This wet cement paste slurry has a potentially negative proposition for building teams, as they then have to contend with U.S.

Environmental Protection Agency compliance issues for its proper disposition. Slurry cannot simply be washed down a sanitary sewer. EPA regulations require the containment of concrete washout. Improper disposal may result in financial penalties and liabilities to the responsible parties. Finally, the building team must anticipate extra time and costs for a wet grind floor resurfacing project. Wet slurry disposal efforts, then, may become a significant factor in delivering a project on time and within budget.

The USGBC is a non-profit coalition of building industry professionals. They seek to improve the environmental quality of buildings and communities. The USGBC has set the leading national standard for green building: the LEED Green Building Rating System. LEED is a voluntary consensus-based national standard developed by the USGBC to support and validate green building design, construction and operations.

Although LEED is currently (or soon will be) available for several specialized types of projects, such as schools, health care facilities, homes, existing buildings, core and shell construction and neighborhoods, this paper covers the version 2.2 of LEED for New Construction and Major Renovations.



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**Section 5:  
USGBC and the  
LEED Green  
Building Rating  
System  
(Continued)**

The LEED-NC version 2.2 rating system contains six separate categories:

1. Sustainable Sites
2. Water Efficiency
3. Energy & Atmosphere
4. Materials & Resources
5. Indoor Environmental Quality
6. Innovation & Design Process

Within these six categories, there are also seven prerequisites which must be met before proceeding with a LEED project:

1. Construction Activity Pollution Prevention
2. Fundamental Commissioning of the Building Energy Systems
3. Minimum Energy Performance
4. Fundamental Refrigerant Management
5. Storage & Collection of Recyclables
6. Minimum Indoor Air Quality Performance
7. Environmental Tobacco Smoke (ETS) Control

The maximum score, theoretically, is 69 points. Because of the unique elements of every building, however, no project can gain all the points possible. Projects must achieve a minimum of  
**26 points in order to be LEED certified,**  
**33 points to attain a silver rating,**  
**39 points for gold, and**  
**52 points for a platinum rating.**

The LEED-EB (Existing Buildings) and LEED-CI (Commercial Interiors) rating systems have similar categories to the LEED-NC rating system, although prerequisites and points differ.

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**Section 6:  
LEED-NC 2.2  
(New Construction  
and Major  
Renovations,  
version 2.2)**

Polished Concrete Floor Systems can potentially contribute points within several of the LEED-NC rating system categories. These include Materials & Resources, Energy & Atmosphere, and Environmental Quality. This new generation of dry applied polished concrete process, and concrete floors in general, can theoretically contribute *at least five points toward LEED-NC certification* in the following categories:

**MR (Materials & Resources) Credits 1.1, 1.2 & 1.3- Building Reuse (1 point each)**

The intent of the Building Reuse credits is to extend the life span of existing buildings. This practice will help to conserve resources,



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**Section 6:  
LEED-NC 2.2  
(New Construction and  
Major Renovations,  
version 2.2)  
(Continued)**



“VOC-Free FGS Hardener Plus chemically hardens and densifies concrete surfaces, extending the life of the surface while reducing cost, delivering superior shine, safety, and NFSI Certified Non-Slip performance.”

retain cultural resources, reduce waste and reduce the environmental impacts of new buildings as they relate to materials, manufacturing and transport. A Polished Concrete Floor System fulfills much of the intent of this LEED-NC category.

The requirements of this category are also available with the Polished Concrete Floor Process, including the use of existing interior non-structural elements (interior walls, doors, floor coverings and ceiling systems) in at least 50% (by area) of the completed building (including additions). If the project includes an addition to an existing building, this credit is not applicable if the square footage of the addition is more than 2 times the square footage of the existing building.

The FGS/PermaShine contribution to MR Credits 1.1, 1.2, & 1.3 is wide and varied. An FGS/PermaShine Polished Concrete Floor will last the lifetime of a building and accommodate a variety of future occupant requirements. In projects where the concrete flooring comprises more than 75 percent to 95 percent of the materials in the original building, the FGS/PermaShine process may assist a building team with points toward LEED-certification of a major renovation. These projects can include buildings with large expanses of concrete floor that can be reused, such as in warehouses or retail showrooms. This product (or process) can also reduce the impact from construction or demolition in several ways. For example, polished concrete process involves resurfacing of an existing concrete floor, as well as the elimination of demolition and the diversion of resources from the landfill. Depending on the size of the floor, this process may also contribute to maintaining 50 percent of the interior non-structural elements and therefore extend the life cycle of the building's existing flooring materials.

**MR (Materials & Resources) Credit 3.1, 3.2- Material Reuse:  
5%, 10% (1 point)**

The intent of the MR Credit 3.1: Materials Reuse: 5% is to reuse building materials and products in order to reduce demand for virgin materials and to reduce waste. This practice reduces impacts associated with the extraction and processing of previously undisturbed resources.

The requirement for this credit is to use salvaged, refurbished or reused materials such that the sum of these materials constitutes at least 5%, based on cost, of the total value of the materials on the project. The calculation for this credit can only include materials permanently installed in the project.

The intent of MR Credit 3.2: Materials Reuse: 10% is the same as



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**Section 6:  
LEED-NC 2.2  
(New Construction and  
Major Renovations,  
version 2.2)  
(Continued)**

with Credit 3.1 with the additional requirements that building teams use salvaged, refurbished or reused materials such that the sum of these materials constitutes at least 10%, based on cost, of the total value of the materials on the project.

The FGS/PermaShine Contribution (MR Credits 3.1 and 3.2): An FGS/PermaShine Polished Concrete Floor System allows building teams to gain LEED points by refurbishing permanently installed concrete flooring, because this strategy reduces the demand and impact of extracting and processing raw materials. To gain the points, a project with a Polished Concrete Floor System should enable the reuse of existing concrete materials that cost at least 5 percent, and possibly up to 10 percent of the total materials on the project.

Prior to major renovations many building owners consider the slab obsolete once as little as the top 1/8 inch of the slab (or Near Surface Wear Zone) is worn. However, a Green Polished Concrete Floor opens up the potential for reuse of the slab.

**MR Credit 4.1: Recycled Content: 10% (post-consumer + 1/2 pre-consumer) (1 point)**

The intent of this credit is to increase demand for building products that incorporate materials containing recycled content. This practice helps reduce the impact that can result from the extraction and processing of virgin materials.

The requirements for a building team to gain this point means using materials with recycled content. Here, the sum of their post-consumer recycled content plus ½ of their pre-consumer content must constitute at least 10% (based on cost) of the total value of the materials in the project.

An FGS/PermaShine Polished Concrete Floor System utilizing a concrete slab containing fly ash as an additive and Portland cement replacement can assist building teams with points in this category.

The addition of fly ash to concrete is considered to be a green practice because its use recycles the ash. It also can replace up to 30 percent of the Portland cement. The manufacturers of Portland cement have recently gained recognition from the U.S. Environmental Protection Agency for significantly reducing its environmental footprint through increasing energy efficiency, cutting air emissions and better managing its manufacturing process, according to Permanent Buildings & Foundations Magazine (p. 67, Nov. 2006). The article mentions 10 years of data was collected by



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**Section 6:  
LEED-NC 2.2  
(New Construction and  
Major Renovations,  
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(Continued)**

the EPA and its report noted that the industry has cut cement kiln dust disposed of in landfills by half (49 percent) since 1995; and reduced the rate of nitrogen oxide emissions by 6 percent between 1996 and 2002. The agency also noted that the cement industry accounts for less than 1 percent of the carbon dioxide emissions.

Portland cement manufacturers also use alternative fuels sources such as municipal waste in order to produce the product. This practice can divert solid waste from landfills.

Flyash also offers other secondary environmental advantages, such as reducing the water demand because it improves the performance, quality of the concrete and the plastic properties of concrete. The more plastic the concrete, the more efficiently the concrete slab can be placed and finished.

Flyash for use in Portland cement concrete shall conform to the requirements of ASTM C 618, Standard Specification for Flyash and Raw or Calcined Natural Pozzolan Class C Flyash for use as a mineral admixture in Portland cement concrete.

**MR Credit 4.2: Recycled Content: 20% (post-consumer + 1/2 pre-consumer) (1 point)**

The intent of this credit is the same as the Credit 4.1. However, the requirements differ. Here, building teams must use materials with recycled content such that the sum of their post-consumer recycled content plus 1/2 of their pre-consumer content constitutes an additional 10% beyond MR Credit 4.1 (total of 20%, based on cost) of the total value of the materials in the project.

While the FGS/PermaShine densifier does not contain any recycled material, it is applied to a Polished Concrete Floor System which, when viewed as an assembly containing recycled content, can contribute to credits in this section of LEED.

**MR (Materials & Resources) Credit 5.1, 5.2 Regional Materials: 10% Extracted, Processed & Manufactured Regionally (1 point)**

The intent of this credit is to increase demand for building materials and products that are extracted and manufactured within the region. Thereby, it supports the use of indigenous resources and reduces the environmental impacts resulting from transportation. L&M Construction Chemicals is located in Omaha, Nebraska, and has satellite manufacturing plants in Pottstown (Philadelphia),



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**Section 6:  
LEED-NC 2.2  
(New Construction and  
Major Renovations,  
version 2.2)  
(Continued)**

Pennsylvania and Portland, Oregon. Building projects within the LEED-prescribed radius of this area could potentially qualify for this credit.

The credit requirements call for the use of building materials or products that have been extracted, harvested or recovered, as well as manufactured, within 500 miles of the project site for a minimum of 10% (based on cost) of the total materials value. If only a fraction of a product or material is extracted/ harvested/ recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.

The MR Credit 5.2: Regional Materials: 20% Extracted, Processed & Manufactured Regionally requirements are similar to Credit 5.1. The difference here is that use of building materials or products that have been extracted, harvested or recovered, as well as manufactured, within 500 miles of the project site must come to an additional 10% beyond MR Credit 5.1 (total of 20%, based on cost) of the total materials value.

**EA (Energy & Atmosphere) Credit 1: Optimize Energy Performance (1-10 points)**

The intent of this category or credit is to establish the minimum level of energy efficiency for the proposed building and systems. In order to meet this credit standard, the building team must design the building to comply with both the mandatory provisions of ASHRAE/IESNA Standard 90.1-2004 AND the Prescriptive Requirements of 90.1 OR the Section 11 Performance Requirements of 90.1 (without amendments) OR the requirements in the local energy code (whichever criteria is more rigorous).

An FGS/PermaShine concrete floor system can be part of a whole building approach to maximize a building's energy efficient design because of the thermal mass of a concrete floor. The thermal properties of concrete floors can reduce the cooling and heating loads within a building envelope.

Reflective properties from the high gloss finish of the FGS/PermaShine floor system can also ease the energy requirement for lighting interiors. L&M Construction Chemicals also offers various surface coloration products, for both new and existing concrete floors. These can offer additional light reflectancy properties to provide further potential for a reduction in lighting requirements. This strategy is of particular importance to building teams seeking a design to maximize the natural light entering the building, or design



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**Section 6:  
LEED-NC 2.2  
(New Construction and  
Major Renovations,  
version 2.2)  
(Continued)**

and implementation of a day-lighting strategy, because it also can contribute to a whole building approach to energy reduction.

The number of LEED points available in this section of the Green Building Rating System for a Polished Concrete Floor System will depend on the area of the building with concrete flooring. For example, if the building team can document that the concrete floor has increased the energy efficiency of a building by 10.5 percent over the baseline building performance rating per ASHRAE/IESNA Standard 90.1-2004, then LEED-NC awards 1 point. Theoretically, a maximum of 10 points could be awarded for a 42 percent increase in energy efficiency. Some of that increase is potentially due to the thermal mass of a concrete floor assembly.

Long term, the Polished Concrete Floor System saves energy typically used on other floor finishes for maintenance because the more foot traffic on the Polished Concrete Floor System the shinier the floor becomes.

A product such as the FGS Conditioner was developed by L&M Construction Chemicals to eliminate the frequent waxing and other surface maintenance products and procedures. The maintenance of a Green Polished Concrete Floor System can represent a 65% reduction in maintenance costs in addition to the energy saved to implement the flooring upkeep portion of an overall facilities maintenance plan.

**EQ Credit 4.1: Low-Emitting Materials: Adhesives & Sealants  
(1 point)**

The intent of this credit is to reduce the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well being of installers and occupants. To gain points in this credit category, the building team must specify that all adhesives and sealants used on the interior of the building shall comply with the requirements of South Coast Air Quality Management District (SCAQMD) Rule #1168.

The FGS/PermaShine process can reduce the quantity of indoor air contaminants that are odorous, irritating and harmful to the comfort and well-being of installers and occupants of a building, as required by the USGBC. The chemical treatments in FGS/PermaShine densifier are VOC-free and comply with SCAQMD Rule #1168. They also do not exceed the VOC content limits established in SCAQMD Rule #1113, Architectural Coatings. The FGS/PermaShine densifier does not contain solvents.



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**Section 6:  
LEED-NC 2.2  
(New Construction and  
Major Renovations,  
version 2.2)  
(Continued)**



“Up to 98% of the potential airborne grid particles are captured in a vacuum filter during installation of a mechanically installed Polished Concrete Floor System. This allows warehouse workers and valuable stock or cargo items to remain on site during installation.”

The L&M Vivid Dye is a post-hardening concrete coloration system for building projects that specify a color scheme. It is available in both a water-based and VOC-exempt solvent (acetone). As a result, it does not contribute to urban smog conditions. The acetone present during the application of Vivid Dye products evaporates within minutes of spraying.

In addition, concrete floors can provide relief to building occupants who are susceptible to allergies, according to Austin Energy's Green Building Program. Concrete finish floors are a good choice for allergy relief because concrete does not hold dust, mold, dust mites or pollens compared to carpeting.

**LEED-NC Version 2.2 - Innovation in Design (2 points)**

L&M Construction Chemical product representatives have developed the further potential for Innovation in Design credits. These credits provide design teams and projects the opportunity for LEED points for innovative performance in areas not specifically addressed by the LEED-NC Green Building Rating System.

The FGS/PermaShine process can potentially contribute points in this category of LEED because of its slurry-free installation method. This is the most advanced installation process for Polished Concrete Floor Systems currently available. The dry, mechanical method of installation for concrete floor or concrete surface restoration is completed through the grinding of a concrete surface. It continues with the extracting and retaining of the dust during the grinding process.

This vacuum-captured byproduct can be collected in lightweight 20-pound bags and safely disposed in a sanitary landfill. Initial efforts are underway to recycle the residue as filler in paving for asphalt road projects. One of the prerequisites for a LEED project is an area set aside for separation of recycled materials. A building team that specifies Polished Concrete Floors can utilize its already designated recycling area for collection of the calcium byproduct without significant extra effort, other than providing documented instructions to the building team.

The FGS/PermaShine process is different from the first generation of Polished Concrete Floor Systems that mimic terrazzo grinding techniques. First generation systems require heavy water use during the grinding steps, wasteful and repeated coats of a chemical densifier which is subsequently ground off, and produce a wet and heavy slurry that is difficult and costly to dispose of. This slurry

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version 2.2)  
(Continued)**

presents a potentially negative proposition for building teams, which must contend with Environmental Protection Agency compliance issues. The slurry cannot simply be washed down a sanitary sewer. A work site that generates slurry also has to be anticipated. Time and costs for floor resurfacing preparation are also a large factor in project costs and time with the earlier Polished Concrete Floor Systems.

**EQ (Indoor Environmental Quality) Credit 7.2: Thermal Comfort: Verification (1 point)**

This credit category and the one following are two that virtually any building team can anticipate receiving points for, if the strategy is documented and implemented according to LEED standards.

The intent of this EQ Credit 7.2: Thermal Comfort is to provide for the assessment of building thermal comfort over time. To gain a point in this category under Credit 7.2, the building team is required to implement a thermal comfort survey of the building's occupants within a period of six to 18 months after occupancy. This survey should collect anonymous responses about thermal comfort in the building that will include an assessment of overall satisfaction with thermal performance and identification of thermal comfort-related problems. Building owners must then agree to develop a plan for corrective action if the survey results indicate that more than 20% of occupants are dissatisfied with thermal comfort in the building. This plan should include measurement of relevant environmental variables in problem areas in accordance with ASHRAE Standard 55-2004.

The FGS/PermaShine Process can contribute to this credit (EQ Credit 7.2) because the use of a Polished Concrete Floor System encourages a facility owner to take full benefit of the thermal properties of concrete. In-floor radiant or passive solar heating and cooling are considered by many to be very efficient and comfortable. Polished concrete can expose more concrete mass, which adds to the thermal mass, which in turn reduces heating and cooling loads. Therefore, it aids in fulfillment of credit compliance. Taking into account the thermal comfort enhancements described above, having a Polished Concrete Floor System increases the probability that 80% of occupants will be satisfied with the temperature controls at their workstations.



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**Section 6:  
LEED-NC 2.2  
(New Construction and  
Major Renovations,  
version 2.2)  
(Continued)**

**Precautionary Note**

The preceding LEED credit section references are for suggested applications of FGS/PermaShine. The LEED applicant is ultimately responsible for determining the product attributes that will help provide LEED-certification of a building project. Under the LEED-NC categories suggested, Polished Concrete Floor Systems can assist building teams in obtaining a minimum of five LEED points as long as the overall design meets or exceeds the LEED building performance standards.

The final decision on LEED product compliance relies heavily on the work of the LEED Accredited Professional retained for any specific project and ultimately with the judging panel at USGBC. The role of the architect, designer, contractor or other member of the building team is to document a building's sustainable design, construction and performance data, and to make the data available to the LEED AP. In turn, the LEED AP can prepare the final documentation sent to the USGBC for a positive outcome.

**Other LEED Applications**

FGS/PermaShine can also potentially assist in gaining points in other LEED Green Building Rating Systems. Among others, these include LEED for Existing Buildings, LEED Core and Shell, LEED for Homes, as well as others still under development such as LEED for Schools, LEED for New Retail construction, and LEED for Healthcare.

In addition to meeting several prerequisites, it takes a minimum of 26 points to gain LEED Certification for a building. The additional points needed for LEED certification in buildings using FGS/PermaShine can be gained in other categories, including sustainable site and water efficiency.

While LEED is the national benchmark for sustainable design and construction, FGS/PermaShine can also help building teams comply with many other "green" building standards, including the Green Building Initiative's Green Globes and various other national and regional standards.

Most of the credits are achievable early in the building's life while a few, such as Building Reuse and Material Reuse, are long-term sustainability strategies that can pay off later in the building's life. Documentation demonstrating compliance with credit requirements may come from L&M Construction Chemicals, architects, general



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**Section 6:  
LEED-NC 2.2  
(New Construction and  
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(Continued)**

contractors, mechanical engineers, and certified FGS/PermaShine installers. To obtain further verification of the contributions that L&M products provide to LEED projects, including the FGS/PermaShine Polished Concrete Process, visit [www.lmcc.com](http://www.lmcc.com) or [www.fgs-permashine.com](http://www.fgs-permashine.com).

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**Section 7:  
LEED V2.1 vs V2.2**

The LEED Version 2.2 Rating System maintains all five of the original categories of Version 2.1. Further, all of the original credits may be attained with the help of Polished Concrete Floor Systems. The major technical differences between versions 2.1 and 2.2 as they relate to Polished Concrete Floor Systems are adoption of updated ASHRAE Reference Standards for compliance in the Energy and Atmosphere and Indoor Environmental Quality categories. Other changes to credit requirements are generally minor and should not inhibit compliance. In addition, the submittals section under each credit in the LEED Reference Guide has been omitted to make documentation more flexible and streamlined.

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**Section 8:  
LEED  
Reference Guides**

The USGBC publishes LEED Reference Guides for further information about the standards for credits within the LEED Rating Systems. There are currently available for purchase from the USGBC LEED Reference Guide for New Construction, Existing Buildings, Commercial Interiors and Core and Shell Development.

According to the USGBC, the Reference Guides provide additional information about the documentation required, reference standards, potential design synergies and trade-offs, calculation methods and formulas (among other information). There are LEED-NC Reference Guides for both Versions 2.2 and 2.1.

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**Section 9:  
The Future of  
Green Building  
Rating Systems**

Time is of the essence for designing and registering projects for LEED certification. Changes to the leading green standards are becoming increasingly stricter. For example, in May 2007 the USGBC placed new energy requirements up for vote by its members that would require LEED registered projects achieve a minimum of two Optimize Energy Performance points toward LEED certification.



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**Section 9:  
The Future of  
Green Building  
Rating Systems  
(Continued)**

This requirement would impact LEED for New Construction, Existing Buildings, Commercial Interiors, and Core & Shell in future versions of the rating system.

In addition to stricter energy conservation requirements, the USGBC, several partner industry organizations and public sector representatives have taken another step forward. The USGBC announced on May 14 that the American Institute of Architects (AIA), the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), Architecture 2030, the Illuminating Society of North America (IESNA) and the USGBC, supported by representatives of the US Department of Energy, finalized a memorandum of understanding. This memorandum established a common starting point and goal of net zero energy buildings.

To reach the energy reduction goal, AIA, ASHRAE, Architecture 2030, IESNA and USGBC agreed to define the baseline starting point for their common target goals. This baseline starting point is the national average energy consumption of existing U.S. commercial building as reported by the 2003 Commercial Building Energy Consumption Survey (CBECS), according to the USGBC. CBECS data is a set of whole-building energy use measurements gathered by the DOE's Energy Information Administration. It can be used to determine a national energy use intensity using kBtu/sqft/yr as the metric.

ASHRAE president, Terry Townsend reports that the current baseline kBtu/sqft/yr for US buildings was 9,100 in 2003. The ASHRAE leader is also on record saying ASHRAE 90.1-2010 will be 30 percent more stringent than the 2004 version (currently the baseline for LEED). ASHRAE supports efforts toward a significant reduction of kBtu/sqft/yr by 2010, and net zero by 2030.

**Standard 189**

Standard 189 is an ASHRAE standard for the design of high performance green buildings except low-rise residential buildings. This standard will effectively convert many of the LEED standards into language that will easily fit into local building codes. It is expected to be released in 2007. Codes around the country will start using Standard 189 as a baseline for local energy and building standards. The implied result is that the voluntary green building guidelines in LEED for green building will no longer be voluntary, but mandatory as Standard 189 migrates into local energy and building codes.



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**Section 9:  
The Future of  
Green Building  
Rating Systems  
(Continued)**

**Architecture 2030 Challenge:**

The Architecture 2030 Challenge is pushing for building teams to design buildings today (2007) that will reduce their CO<sub>2</sub> emissions by 50 percent. The call of this initiative is to also reduce greenhouse gas emissions by 60 percent by 2010, and to be net carbon neutral by 2030. Groups such as ASHRAE announced their participation in this challenge during the USGBC's Denver 2006 GreenBuild show.

**Clinton Climate Initiative:**

Forty mayors of some of the largest cities in the world are seeking adoption of the Clinton Initiative to reduce CO<sub>2</sub> emissions. This protocol has the potential to provide a significant impact on the future health of our planet. The leaders of these cities have established a goal of using the Clinton Initiative to help them lower CO<sub>2</sub> emissions by 80 percent by 2030.

**Additional Initiatives**

The list of organizations now mobilized for the same purpose as those above is growing. The AIA Committee for the Environment, the Globalization Roadmap Report, and the Wal-Mart Collaborative are just a few of this number. Some big-box retailers have made commitments to energy reduction and business practices aimed at lowering CO<sub>2</sub> emissions. In particular, Wal-Mart claims its operations are now 30 percent more energy efficient due to implementation of corporate-wide initiative. It is now turning to its suppliers and asking them to do the same. Other retailers in the Retail Energy Alliance are expected to follow.

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**Section 10:  
Conclusions**

The FGS/PermaShine Polished Concrete Floor Systems address the three most important benefits to green or sustainable building, which the USGBC calls the “triple bottom line.”

1. **Increased profitability through more efficient buildings**
2. **Improved occupant health**
3. **Reduced environmental impact**

The green performance attributes most affecting the above green building benefits, are addressed in the LEED-NC Green Building Rating System as both prerequisites and/or in the point generating LEED credit categories. They are: energy efficiency, indoor environmental quality, and an overall reduction of a building's environmental footprint.

The largest benefit of Polished Concrete Floor Systems is the long-term energy savings. While Polished Concrete is very affordable, the



■■■  
**Section 10:  
Conclusions  
(Continued)**

higher initial cost of sustainable integrated design, documentation and systems commissioning can be minimized or offset through federal or local tax credits for exceeding government mandated energy efficiency goals. In some jurisdictions, developer incentives such as fast-track permitting and approvals only available for green projects can be passed along to building owners through lower initial construction costs.

An FGS/PermaShine Polished Concrete Floor System also provides occupant or tenant benefits. The thermal mass of a Polished Concrete Floor System increases the potential for greater indoor air comfort by allowing for more efficient and improved individual workstation temperature controls. (Temperature is the leading complaint by building occupants concerning indoor environmental quality, according to the USGBC.) There is anecdotal evidence that a green workplace, such as one with a VOC-free FGS/PermaShine Polished Concrete Floor Process, improves productivity and results in less absenteeism.

Concerning the overall environmental impact of FGS/PermaShine Polished Concrete Floor Systems, the materials requirements of such a system are recyclable. Thereby they have enormous potential for building material reuse, thus reducing a building's environmental impact. Recycled or reused materials mean less transportation energy and costs, and less frequent dumping at landfills.

In addition, the FGS/PermaShine dry or mechanical application process is not specifically addressed in LEED at present. Yet, it most likely would be judged by the USGBC as an Innovation in Design. This process uses less water than earlier introductions of Polished Concrete Floor Systems. It produces less disposable residual byproduct, is slurry-free, and has the potential for the byproduct of this process to be reused as aggregate in road building or other on-site applications. As the USGBC integrates Life Cycle Analysis into its LEED rating system, this installation is likely to be given the credit it deserves for a significant reduction in overall environmental impact of construction compared to other application processes and other flooring options.

Finally, the overall growth in design, construction and operation of green or high performance buildings is expected to increase rapidly in the coming decades. It can be expected that this movement will continue to expand until green buildings become the minimum standards included in local building codes. The LEED Green Building Rating System, as well as other third-party certification programs, will likely guide this evolution.





## Section 10: Conclusions (Continued)

It is also accepted that all stakeholders within the architectural community, including manufacturers such as L&M Construction Chemicals, that stay current on the trend toward sustainable product development, manufacturing, distribution, installation, maintenance and material reuse or deconstruction will gain strong footholds within the architectural industry. They will almost certainly leave behind those others unwilling to change. In other words, this change in the AEC marketplace will create new opportunities for those who embrace, understand and respond to the current green building initiatives.

To obtain further information regarding the contributions that L&M products provide to LEED projects, including the FGS/PermaShine Polished Concrete Process, visit

[www.lmcc.com](http://www.lmcc.com) or

[www.fgs-permashine.com](http://www.fgs-permashine.com).



“The Calgary Recreation Center achieved LEED Gold certification with a Polished Concrete Floor System from FGS/PermaShine”

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