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Polished Concrete & LEED Certification

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Credits:

FGS/PermaShine Polished Concrete Floor Process

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Section 1: Building Green

Faced with government mandates, building owners' demands, and increasingly expensive resources, building teams throughout North America are under pressure to build green. Efforts to mitigate the impact of growth by protecting the environment are having financial as well as social benefits. To participate in this movement, building teams need new design strategies and sustainable products to execute these designs.

Such efforts earn points toward the LEED (Leadership in Energy and Environmental Design) certified building projects. This approach also complies with the growing number of governments adopting LEED as the required benchmark for acquiring permits and, in many locations, also earns tax credits and rebates.

This paper, commissioned by L&M Construction Chemicals Inc., offers ways for building teams to use polished concrete floors to earn potential LEED points for new building construction and major renovations.¹ Specifically, this paper shows how an economical and aesthetically pleasing polished concrete system, FGS/PermaShine, manufactured by L&M Construction Chemicals, Inc., can assist building teams with LEED certification.

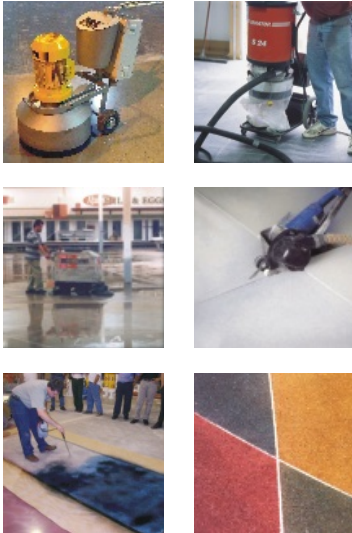
According to the U.S. Green Building Council (USGBC), buildings use one-third of our total energy, two-thirds of our electricity, one-eighth of our water, and transform land that provides valuable ecological resources. For these reasons, increasing efforts are underway to reduce a building's energy requirements and thereby reduce its environmental impact.

Environmental issues constitute only one reason to build green, however. From an economic standpoint, green building practices can result in energy and cost savings over the life of a structure. For example, the U.S. Environmental Protection Agency (EPA) estimates that tenants or building owners can save about 50 cents per square-foot by using strategies that cut energy use by 30 percent. This represents a savings of \$50,000 or more in five-year operational costs on 20,000 square feet. In addition, studies of workers in green buildings show increased labor productivity, job retention, and days worked. Students in these environments have higher test scores and lower absenteeism. Retail sales are higher in day-lit buildings. Not only is building green socially responsible, but it makes sense financially.



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

Section 2: USGBC and the LEED Green Building Rating System



Representing the entire building industry, the USGBC is a non-profit coalition of building industry professionals. Since its inception in 1993, its mission has been to improve the environmental quality of buildings and communities. The USGBC set the national standard for green building by developing the LEED Green Building Rating System. First published in 1999, LEED supports and validates green building design, construction, and operations via its voluntary, consensus-based national standard.

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 only version 2.2 of LEED for New Construction and Major Renovations (LEED-NC).

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

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

Within these six categories, the following seven prerequisites must be met:

1. Construction activity pollution prevention,
2. Fundamental commissioning of the building energy systems,
3. Minimum energy performance,
4. Fundamental refrigerant management,
5. Storage and collection of recyclables,
6. Minimum indoor air quality performance, and
7. Environmental tobacco smoke (ETS) control.

The maximum possible score per building project is 69 points. However, because of the unique elements in each building, no project to date has gained all the possible points. A project must achieve a minimum of:

- 26-32 points in order to be LEED certified,
- 33-38 points to earn a silver rating,
- 39-51 points to earn a gold rating, or
- 52-69 points to earn a platinum rating.

While LEED-EB (Existing Buildings) and LEED-CI (Commercial Interiors) rating systems use categories similar to the LEED-NC rating system, prerequisites and the points scale for those systems differ.

Section 3: Other Green Building Rating Systems

Other sustainability or building performance rating systems exist. (*See Item 1, Building Rating Systems, in the Addendum to this paper.*) However, LEED-NC was not only the first U.S. system to rate the environmental impact of new commercial buildings (mainly offices), but it continues to be today's benchmark.

Section 4: Polished Concrete Flooring in LEED Certified Projects

Building projects with concrete floors offer a unique opportunity to potentially earn points toward LEED-NC certification. Thanks to new advances in concrete surface treatments, polished concrete floors offer cost-effective, aesthetically pleasing and healthier alternatives to terrazzo, vinyl, carpet, tile, and other floor surfaces.

LEED does not assign points for specific products. However, this paper provides information for building teams interested in using polished concrete floors for LEED-NC certification.

Concrete flooring systems are a smart way to earn LEED-NC points because they can offer:

1. Improved thermal mass for reduced peak energy demand,
2. Potential for reusing existing building materials, and/or
3. Inclusion of post-consumer and post-industrial recycled materials.
4. Low VOC floor finishing material
5. Low life cycle maintenance cost

Section 5: A Patented Dry Grinding and Polishing Process

The most environmentally advanced polished concrete floor systems include dry/mechanical grinding installation methods. For new concrete floors or concrete surface restoration, L&M Construction Chemicals, Inc. offers a patented process called FGS/PermaShine.² The basic equipment used for this polishing process is a walk-behind, diamond disc grinder for working large floor areas. FGS/PermaShine's process uses highly efficient HEPA filter vacuum air-purification technology to collect dust generated during the dry abrasive grinding and smoothing process. Because dust is captured and collected in lightweight bags, the jobsite atmosphere is virtually clear of airborne dust produced while preparing the surface.



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

Dry grinding differs from earlier methods used to prepare polished concrete floor systems. Earlier systems mimic classic terrazzo grinding techniques which require the use of large quantities of water during the grinding process, repeated coats of chemical densifier, and end up producing wet, concrete slurry. With the resulting wet, cement-paste slurry comes the EPA. Slurry cannot simply be washed down a sanitary



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**Section 5:
A Patented
Dry Grinding and
Polishing Process
(Continued)**

sewer; building teams need to dispose of the slurry in accordance with regulations set forth by the EPA which require containment of concrete washout. Improper disposal may result in financial penalties and other liabilities. Further, building teams need to expect extra time and costs for a wet grind floor resurfacing project. Wet slurry can prevent a project from completing on time and within budget.

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



Within several LEED-NC rating system categories, polished concrete floor systems can contribute points. (See LEED-NC Planning Tool provided with this paper.) These categories include Energy and Atmosphere, Materials and Resources, and Environmental Quality. Dry-ground polished concrete floors hold the possibility of contributing a number of points toward LEED-NC certification in the following categories:

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

EA Credit 1 identifies the minimum levels of energy efficiency for the proposed building and its systems and then awards points based on exceeding the minimum benchmark in ASHRAE 90.1-2004. The building team must conform to one of four options. One of these options, Whole Building Energy Simulation, asks the builder to demonstrate a percentage improvement in the proposed building's performance rating compared to the baseline building performance rating per ASHRAE/IESNA Standard 90.1-2004.

Because the thermal mass of concrete floors reduces cooling and heating loads within a building envelope, especially during periods of peak energy demand, a polished concrete floor system, such as FGS/PermaShine, can be a significant part of a whole-building approach to improving the building's energy-efficient design.

Reflective properties of the high gloss finish of a polished concrete floor reduce initial light fixture costs by reducing the amount of ambient lighting fixtures needed, as well as reducing the energy needs for existing interior lighting. L&M Construction Chemicals, Inc. calculated that depending on the type of colored floor used in the FGS/PermaShine process, the floor surface can increase the reflection of as much as 35 percent of light, further increasing energy performance. Remarkably, with simple maintenance an FGS/PermaShine floor becomes shinier over time, even with increased foot traffic, which in turn can add to the high-gloss reflectivity of the system.



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



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

Strategies involving high reflectivity are particularly important to building teams seeking to maximize the natural light entering the building or designing and implementing day-lighting. These and other efficient lighting designs increase energy performance and earn points.

Because topical floor waxes are never needed with FGS/PermaShine polished concrete, maintenance costs are low (usually around \$0.25 per square foot per year) and energy consumed maintaining the floor finish is less. Instead of frequent waxing and sealing, regular use of FGS/Concrete Conditioner keeps the floor shiny and clean, reducing the amount of power needed to run floor maintenance equipment on other types of floor systems. Recent reports suggest that maintaining a green FGS/PermaShine polished concrete floor can reduce long term maintenance costs by as much as 65 percent. *(See Item 4 in the Addendum to this paper.)*

Using polished concrete, it is possible to contribute toward the ten points available in the EA (Energy and Atmosphere) Credit 1: Optimize Energy Performance category. All projects registered after June 26, 2007 must achieve a minimum of two points. *(See Item 2, Optimized Energy Performance, in the Addendum to this paper.)*

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

MR Credit 1.1, 1.2, or 1.3 aims to extend the life span of existing building materials, conserve resources, retain cultural resources, reduce waste and reduce environmental impacts of new buildings as they relate to materials, manufacturing, and transport. The polished concrete process can be used to refurbish concrete floors and earn LEED points. Renovations where concrete flooring comprises more than 75 % and up to 95 percent of the materials in the original building, such as in schools, retail showrooms, or warehouses, offer potential for earning LEED points in these categories.

The FGS/PermaShine floor system can last the lifetime of a building and accommodate future building uses. Reusing the existing concrete floor reduces the impact of construction by eliminating demolition and diverting resources from landfills.

MR Credit 1.1 calls for maintaining at least 75% (based on surface area) of a building's structural elements. MR Credit 1.2 requires maintaining 95% of a building's structural elements. Maintaining structural flooring is specifically included in suggestions for earning points. Because structural flooring can be resurfaced and reused with FGS/PermaShine, points in this category are possible using such a process.

MR Credit 1.3 calls for maintaining 50% (by area) of interior non-structural elements. Because the FGS/PermaShine process extends the



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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.”

life cycle of interior concrete surfaces, such as floors or counter tops, earning points in this category also is possible. Note that 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 two times the square footage of the existing building.

**MR (Materials and Resources) Credit 3.1, 3.2 – Material Reuse
- (1 point each)**

MR Credit 3.1 or 3.2: Materials Reuse aims to reuse salvaged or deconstructed materials to reduce demand for virgin materials and reduce waste. Points in this category also lower the impact of extracting and processing raw material.

One point for meeting MR Credit 3.1 requirements can be earned by using salvaged, refurbished, or reused materials so that, based on cost, the sum these materials makes up at least 5% of the total value of materials on the project. Meeting CR Credit 3.2 requirements and earning an additional point means using materials that make up at least 10% of the total value of material on the project based on cost. The calculation for this credit includes only material permanently installed. LEEDS-NC suggests reusing flooring as a way to earn points in these categories.

Under certain conditions, the concrete slab portion of a FGS/PermaShine polished concrete floor can be deconstructed and “repurposed” for other interior surfaces such as counters, benches, or window sills, thereby salvaging the surface-treated slab and diverting resources from landfill.

A FGS/PermaShine floor system facilitates refurbishing permanently installed concrete flooring. This approach reduces the demand for and impact of extracting and processing raw materials. Historically, building owners considered the concrete slab unusable once as little as 1/8 inch of the slab (or near surface wear zone) was worn. A polished concrete system, however, offers the potential for reusing the slab and earning points in this category.

MR Credit 4.1, 4.2 – Recycled Content (1 point each)

MR Credit 4.1 or 4.2 aims to increase demand for building products that incorporate recycled content materials, thereby reducing impacts resulting from extraction and processing of virgin materials.

MR Credit 4.1 calls for using recycled content so that the sum of post-consumer recycled content plus one-half of the pre-consumer content makes up at least 10 percent (based on cost) of the total value of materials in the project. MR Credit 4.2 calls for at least 20 percent.



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

An FGS/PermaShine polished concrete floor system can be used on a concrete slab containing fly ash as an additive. Fly ash, a recycled material produced from coal combustion in our nation's electrical power plants, can replace up to 30 percent of portland cement used in concrete. Using fly ash instead of portland cement recycles the ash and helps earn points in these categories. In addition, portland cement manufacturers also use alternative fuel sources, such as municipal waste, in order to produce the product. Therefore, the use of portland cement concrete with fly ash will divert solid waste from landfills.

Fly ash offers other secondary environmental advantages, such as reducing water demand while improving the performance and plastic properties of concrete. The more plastic the concrete, the more efficiently a concrete slab can be placed and finished. Fly ash used in portland cement concrete must conform to the requirements of ASTM C 618, Standard Specification for fly ash and Raw or Calcined Natural Pozzolan Class C fly ash for use as a mineral admixture in portland cement concrete.

While the FGS/PermaShine hardener/densifier does not contain any recycled material, it is applied to a FGS/PermaShine polished concrete floor system which, when viewed as an assembly containing recycled content, can contribute to LEED points in this credit category.

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

The aim of these credits is to increase demand for building materials and products extracted, processed, and manufactured within 500 miles of the building project. This practice supports the use of indigenous resources and reduces the environmental impacts resulting from transportation.

To earn one LEED point, MR Credit 5.1 requires that at least 10 percent of building materials (based on cost) be extracted, processed, and manufactured within 500 miles of the project. MR Credit 5.2 raises the percentage to 20% and offers an additional point. If only a fraction of a product or material is extracted/harvested/recovered/or manufactured locally, then only that percentage (by weight) contributes to the regional value.

Manufacturing plants for FGS/PermaShine are located in Omaha, Nebraska; Portland, Oregon; and Pottstown (Philadelphia area), Pennsylvania. Building projects within the LEED-prescribed 500-mile radius of any of these locations could qualify for this credit. *(See Map Included with this paper.)*



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



The patented
FGS/PermaShine Dry
grinding process minimizes
landfill wastes.

EQ Credit 4.2: Low-Emitting Materials: Paints and Coatings (1 point)

This credit aims 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 earn one LEED point in this credit category, the building team must specify that all paints and coatings used on the interior of the building shall comply with the requirements of South Coast Air Quality Management District (SCAQMD) Rule #1113.

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 treatment in the FGS/PermaShine densifier, FGS Hardener Plus, is VOC-free and complies with SCAQMD Rule #1113. FGS Hardener Plus, the systems' densifier, does not contain solvents or other VOC materials.

The L&M Vivid Dye is a post-hardening concrete coloration system for building projects that specify a color scheme. It is available either in a water-based, low VOC or in a VOC-exempt solvent (acetone). The acetone-based product does not contribute to urban smog conditions. Further, the acetone present when applying Vivid Dye products evaporates rapidly after spraying.

According to **Austin Energy's** Green Building program, concrete finished floors are a good choice for allergy relief because, compared to carpeting, concrete does not hold dust, mold, dust mites, or pollens.

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

EQ Credit 7.2 Thermal Comfort aims to provide for the assessment of a building's thermal comfort over time.

To earn 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 collects anonymous responses about thermal comfort in the building including an assessment of overall satisfaction with thermal performance and identification of thermal comfort-related problems. If the survey results indicate that more than 20 percent of the occupants are dissatisfied with thermal comfort in the building, the building owner must then agree to develop a plan for corrective action. This plan should include measurement of relevant environmental variables in problem areas in accordance with ASHRAE Standard 55-2004.



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

Using an FGS/PermaShine polished concrete floor takes full advantage of the beneficial thermal properties of concrete and can contribute points toward this credit. With polished concrete the concrete surface is fully exposed which, in turn, adds to the thermal mass. Greater thermal mass reduces heating/cooling loads while improving comfort levels. In-floor radiant or passive solar heating/cooling, which are considered very efficient and comfortable, can be used with the system. Because of the thermal comfort enhancement described above, a FGS/PermaShine floor system increases the likelihood that occupants will be satisfied with temperature controls in their buildings.

ID (Innovation and Design Process) ID Credit 1.1, 1.2, 1.3, and 1.4 (1 point per ID Credit)

The Innovation and Design Credit categories of LEED are intended to provide a place for points to be awarded for exceptional performance above and beyond the requirements set by LEED-NC. Points can be earned in categories not specifically addressed by LEED-NC. To earn credits in these categories the intent of the proposed innovation credit must be identified, the proposed requirement for compliance and proposed submittals to demonstrate compliance must be stated along with the design approach that might be used to meet the requirements.

With FGS/PermaShine at least two areas not specifically addressed by LEED NC open up for points in this category: 1) Innovation in Design for Water Efficiency and 2) Design for Sanitary/Recycled Byproduct.

Those seeking points in Innovation in Design for Water Efficiency can factor that the FGS/PermaShine process is different from the first generation of polished concrete floor systems that mimic terrazzo grinding techniques. First-generation systems need heavy water use during the grinding steps and may require wasteful and repeated coats of a chemical densifier. In addition, this treatment is subsequently ground off producing a wet and heavy slurry waste that creates a difficult disposal problem. The FGS/PermaShine process is a dry process and produces no wet slurry and minimal waste.

Those seeking points in Innovation in Design for Sanitary/Recycled Byproduct might consider that because of its patented slurry-free installation method, the FGS/PermaShine process may qualify for one point. The FGS/PermaShine process is a dry, mechanical method of concrete floor installation or surface restoration accomplished by grinding the concrete surface using a technique for extracting and retaining any dust created during the grinding process.

Currently, this vacuum-captured byproduct can be collected in lightweight 20-pound bags for safe disposal in a sanitary landfill.



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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.”

One of the prerequisites for a LEED project is an area set aside for reparation 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.

Precautionary Note

While the LEED-NC credit sections described in this paper suggest how applications of FGS/PermaShine can earn LEED points, the LEED applicant obviously bears the ultimate responsibility for determining product attributes that may earn LEED certification of a building project.

The final decision regarding LEED product compliance relies on the work and judgment of the LEED Accredited Professional (LEED AP) retained for a specific project as well as the judging panel at USGBC. The architect, designer, contractor, or other member of the building team must document a building's sustainable design, construction, and performance data and make the data available to the LEED AP. Then the LEED AP can prepare final documentation which is submitted to the USGBC.

Most LEED points can be earned early in a building's life. Some, such as Building Reuse and Material Reuse, are long-term sustainability strategies that pay off later. Documentation demonstrating compliance with credit requirements may come from L&M Construction Chemicals, Inc., architects, general contractors, mechanical engineers, and certified FGS/PermaShine installers.³

In order to gain the minimum 26 points needed for LEED certification, additional points for LEED-NC certification in buildings using FGS/PermaShine may be obtained in other categories.

Other LEED Applications

LEED-NC is not the only LEED rating system for which FGS/PermaShine can earn points. Other current LEED rating systems include LEED for Existing Buildings (LEED EB), LEED Core and Shell (LEED CS), LEED for Commercial Interiors (LEED CI), and LEED for Home. Other LEED rating systems being developed include LEED for Schools, LEED for New Retail Construction, and LEED for Healthcare.

Section 7: LEED V2.1 vs. V 2.2

The LEED Version 2.2 Rating System retains all five original categories of Version 2.1 in which points may be earned using the FGS/PermaShine polished concrete floor system. The major technical difference between versions 2.1 and 2.2, as they relate to polished concrete floor systems, is the adoption of updated ASHRAE Reference Standards for compliance in the following two categories: 1) Energy and Atmosphere and 2) Indoor Environmental Quality. Other changes to credit requirements are minor and should not impact compliance. In addition, to make documentation more flexible and streamlined, the submittal section under each credit in the LEED Reference Guide has been omitted.

Section 8: LEED Reference Guides

To learn more about LEED-NC including documentation, required reference standards, potential design interactions and trade-offs, calculation methods, and formulas, the USGBC publishes LEED Reference Guides for Versions 2.1 and 2.2.

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 making them increasingly stricter. For example, in June 2007, the USGBC membership voted in favor of adopting the new energy prerequisite for LEED-NC requiring a minimum of two Optimize Energy Performance points (14% optimized energy efficiency beyond ASHRAE 90.1-2004). A new version of LEED is anticipated in 2008 that will likely tighten up the requirements for gaining points.

In addition to more stringent energy conservation requirements, the USGBC, several partner industry organizations, and public sector representatives have taken another step forward. The USGBC announced 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, have finalized a memorandum of understanding that establishes 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



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

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 U.S. buildings was 9,100 in 2003. The ASHRAE leader is also on record stating that the 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.

(See Item 3, Green Building Initiatives in the Addendum to this paper for information about other green initiatives.)

**Section 10:
FGS/PermaShine:
A Green Building
Foundation**

FGS/PermaShine polished concrete floor systems address the three most important benefits of green or sustainable building which the USGBC calls the "triple bottom line." Those benefits are:

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

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



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

The greatest contribution of the FGS/PermaShine polished concrete floor system is long term energy savings. While FGS/PermaShine is very affordable, the higher initial cost of sustainable integrated design, documentation, and systems commissioning can be offset through tax credits for exceeding government-mandated energy goals. In some jurisdictions, developer incentives such as fast-track permitting and approvals available only for green projects can be passed along to building owners through lower initial construction costs.

A FGS/PermaShine polished concrete floor system also provides occupant or tenant benefits. The thermal mass of a FGS/PermaShine floor system increases the potential for greater indoor air comfort by allowing for more efficient and improved individual area temperature



**Section 10:
FGS/PermaShine:
A Green Building
Foundation
(Continued)**

controls. According to the USGBC, temperature is the leading complaint of building occupants concerning indoor environmental quality. There is anecdotal evidence that a green workplace, such as one with the VOC-free FGS/PermaShine polished concrete floor, improves productivity and results in lower absenteeism.

The FGS/PermaShine polished concrete floor system has a lower overall environmental impact because the material required is recyclable. The system also has enormous potential for building material reuse, which reduces a building's environmental impact. Recycled or reused materials mean less energy and cost for transportation and less frequent dumping at landfills.

At present, the FGS/PermaShine dry mechanical application process is not specifically addressed in LEED-NC. 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 that mimic terrazzo wet floor grinding techniques. It produces less disposable residual byproduct, is slurry-free, and has the potential for the byproduct of its 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 system 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 current focus on design, construction, and operation of green or high-performance buildings is expected to continue in the coming decades. And the movement is expected 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. FGS/PermaShine offers solutions for this movement and is proud to be a part of this practical, efficient, wholesome approach to building design and construction.

Submitted by Paul Natcher
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End Notes:

1. Information about the LEED-NC requirements and intent was obtained for this White Paper using the LEED for New Construction & Major Renovations – Version 2.2 Reference Guide, published by the U.S. Green Building Council (USGBC).
2. See MasterFormat Sections 033500 Concrete Finishing and/or 030130 Maintenance of Cast in Place Concrete.
3. For further verification of the contributions that the FGS/PermaShine polished concrete process provide to LEED projects visit www.lmcc.com or www.fgs-permashine.com.

Addendum: Related Information

Item 1: Additional Building Rating Systems

Polished concrete floors may earn points for LEED certification in other rating systems including:

- Energy Star – U.S. Department of Energy program for products and buildings.
- The Green Building Initiative (GBI) awards Green Globes. This U.S. National green building ranking system is directly comparable to LEED-NC.
- SPIRIT – U.S. Air Force sustainability standards.
- CHPS – California Collaborative for High Performance Schools.
- BREEM – English green building rating systems pre-dating Canadian and US LEED.
- Minergy – Swiss government standard for energy efficiency in buildings.
- Go Green – Building Owners & Managers Association (BOMA) of Canada.

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**Item 2:
Optimized Energy
Performance
Credits**

Increased Energy Efficiency

New Buildings	Renovations	Number of Points
10.5%	3.5%	1
* 14.0%	7.0%	2
17.5%	10.5%	3
21.0%	14.0%	4
24.5%	17.5%	5
28.0%	21.0%	6
31.5%	24.5%	7
35.0%	28.0%	8
38.5%	31.5%	9
42.0%	35.0%	10

* FGS/PermaShine treated concrete floors can assist with the minimum 2-points required for LEED projects registered after June 26, 2007.

**Item 3:
Green Building
Initiatives**

Standard 189

Standard 189 is an ASHRAE standard for the design of high performance green buildings excluding low-rise residential buildings. Standard 189 will effectively convert many of the LEED standards into language that will easily fit into local building codes. Soon 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 will no longer be voluntary but mandatory as Standard 189 migrates into local energy and building codes.

Architecture 2030 Challenge

The Architecture 2030 Challenge is pushing for building teams to design buildings that will reduce their CO₂ emissions by 50 percent. The call of the initiative is to also reduce greenhouse gas emissions by 60 percent by 2010 and 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

This protocol has the potential to provide a significant impact on the future health of our planet. The leaders in forty cities have established a goal of using the Clinton Initiative to help lower CO₂ emissions by 80 percent by 2030.

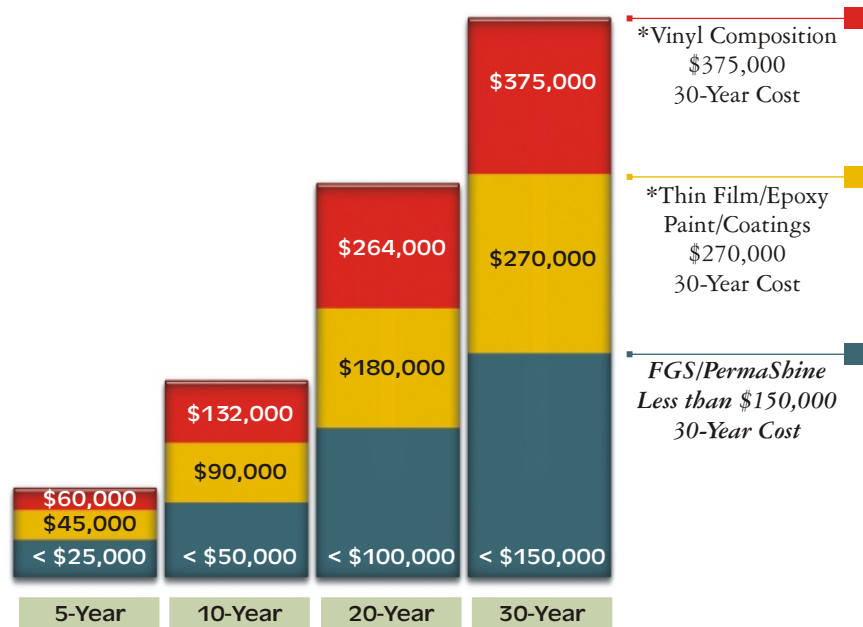


Item 3:
Green Building
Initiatives
(Continued)

Additional Initiatives

The list of organizations now mobilized for the same purposes as those above is growing. The AIA Committee for the Environment, and the Globalization Roadmap Report, and the Wal-Mart Collaborative are just a few. Some big-box retailers have made commitments to energy reduction and business practices aimed at lowering CO2 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.

Item 4:
Life Cycle
Comparative
Cost Analysis



Estimated Average Maintenance and Re-Installation Costs for Floor Treatments Per 10,000 Square Feet for comparison purposes.

* Figures taken from American Terrazzo Association and Concrete Construction Magazine. (Does not include initial installation costs. Includes re-installations at 10-year intervals for vinyl composition tile and 5-year intervals for thin film coatings. No reinstall for FGS PermaShine. FGS periodically maintained and refreshed for \$0.50/square foot or lower, annually. Average reinstallation times and maintenance costs relate significantly to the amount of abuse the floor is exposed to, the quality of the maintenance program, and owner preference.

Item 5:
National Floor
Safety Institute
Certification (NFSI)



FGS®/PermaShine® Floors: High-Traction. Safe.

FGS/PermaShine was the first concrete polishing system approved by the National Floor Safety Institute (NFSI), and is certified as a “High Traction” floor. When used as a part of a comprehensive floor safety program to reduce slips and falls, significant slip-and-fall litigation expense could be saved with FGS.

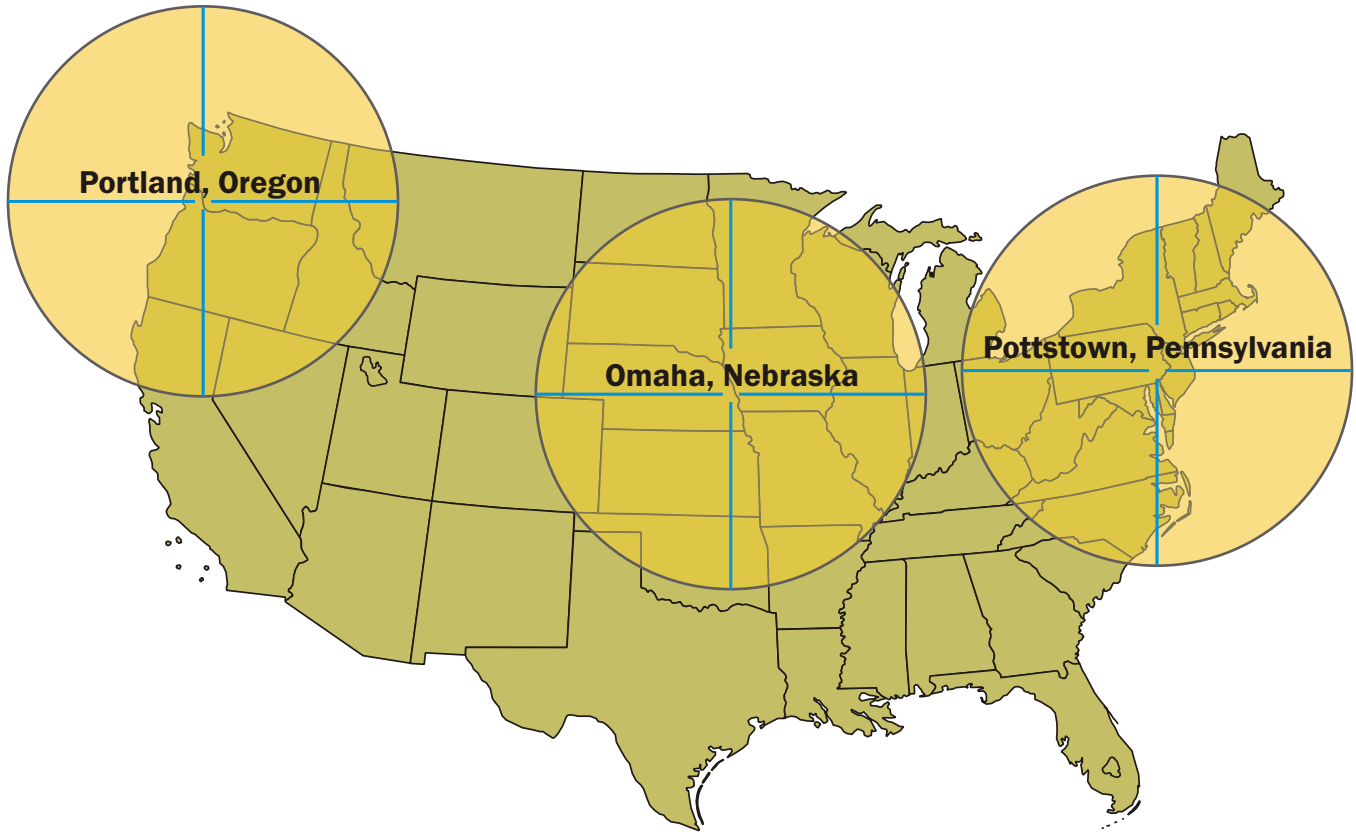
LEED-NC Point Allocation Guide Using FGS/PermaShine Polished Concrete Floors



Category	Credit	Intent	Potential Points	LEED Intent / Requirements	FGS/PermaShine LEED Contribution
Energy & Atmosphere	EA Credit 1	Optimize Energy Performance	1 - 10	Achieve energy performance above the baseline ASHRAE 90.1-2004 through whole building energy modeling. After June 26, 2007, to earn points in this way, energy performance is required to be increased at least 14% for new buildings and 7% for renovations. Meeting these requirements earns 2 points.	Polished concrete floors offer thermal mass which reduces heating and cooling loads. The high gloss finish and optional color create a monolithic reflective surface, resulting in reduced lighting and ongoing energy needs. Because maintaining FGS/PermaShine polished concrete floors requires neither waxing machines nor other energy-intensive equipment, electrical needs decrease.
Materials & Resources	MR Credit 1.1, 1.2	Reuse building by maintaining structural elements	1 point for each section	Extend the life span of buildings, conserve resources, maintain cultural resources, and reduce waste and environmental impact of new construction. Requirement 1.1: Maintain at least 75% (by surface area) of an existing building's structural elements (including structural floors). Requirement 1.2: Maintain at least 95%.	The FGS/PermaShine process resurfaces existing concrete floors avoiding demolition and keeping resources from landfills. FGS/PermaShine polished concrete floors accommodate a variety of present and future occupant requirements. In a renovation, where concrete flooring comprises a large percentage of the original building, FGS/PermaShine can earn LEED points in this category.
	MR Credit 1.3	Reuse building by maintaining non-structural elements	1	Extend the life span of building material, conserve resources, maintain cultural resources, and reduce waste and environmental impact of building products by reusing 50% (by area) of non-structural elements. Requirement: 1.3: Use existing non-structural elements (including floor coverings) in at least 50% (by area) of the completed building (including additions).	The FGS/PermaShine process extends the life cycle of interior concrete surfaces such as floors or counter tops, thereby helping maintain 50 percent of the interior non-structural elements required to qualify for this credit.
	MR Credit 3.1, 3.2	Reuse Materials	1 point for each section	Reuse of salvaged or deconstructed materials in order to reduce demand for virgin materials, reduce waste, and lower impact of extraction and processing of raw materials. Requirement 3.1: Specify salvaged, refurbished or reused materials such that the sum of these materials constitutes at least 5%, based on cost, of the total value of materials on the project. Requirement 3.2: Reuse at least 10%.	The concrete slab component of FGS/PermaShine's floor system can be deconstructed and used for interior surfaces like counters, benches, or window sills. This not only salvages the surface-treated slab but diverts resources from landfills.
	MR Credit 4.1, 4.2	Recycle building content materials	1 point for each section	Increase demand for recycled content materials to reduce impact from extraction and processing of raw materials. Requirement 4.1: Use material with recycled contents so that, based on cost, the sum of post-consumer and one-half of pre-consumer content constitutes 10% of the total value of the materials in the project. Requirement 4.2: Use 20%.	FGS/PermaShine's polished concrete floor system can be used with a concrete slab in which fly ash replaces up to 30% of the Portland cement. Adding fly ash (a recycled material) to concrete helps earn points in this category.
	MR Credit 5.1, 5.2	Use Regional Materials	1 point for each section	Increase demand for building materials extracted and manufactured regionally to reduce environmental impacts of long-distance hauling. Requirement 5.1: Specify products extracted or manufactured within 500 miles of the project site for minimum of 10% of the cost of the total materials value. Requirement 5.2: Specify a minimum of 20%.	Manufacturing plants for FGS/PermaShine System located in Omaha, NE; Portland, OR; and Pottstown, PA (near Philadelphia) may be within 500 miles of your project. Please see the map on the next page for locations within 500 miles of these plants.
Table 3: Indoor Environmental Quality	EQ Credit 4.2	Reduce emissions from materials in paints and coatings	1	Reduce the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants. Requirement: Specify that all adhesives and sealants used on the interior of the building comply with the requirements of South Coast Air Quality Management District (SCAQMD) Rule #1113	FGS/PermaShine's product and process reduce odorous, irritating, and harmful indoor air contaminants, thereby increasing the comfort and well-being of installers and occupants of the building. Concrete surface treatments in the FGS/PermaShine family of products are VOC-compliant according to SCAQMD Rule #1113.
	EQ Credit 7.2	Verify thermal comfort	1	Provide for the assessment of building thermal comfort over time. Requirements: Implement a thermal comfort survey of the building's occupants within a period of 6 to 18 months after occupancy. If 20% of occupants are unsatisfied, develop a plan to correct problems. Include measuring environmental variables in accordance with ASHRAE 55-2004.	FGS/PermaShine floors take full advantage of concrete's beneficial thermal properties. With polished concrete, the concrete surface is fully exposed which, in turn, adds to the thermal mass. Greater thermal mass reduces heating/cooling loads while improving comfort levels. In-floor radiant or passive solar heating/cooling can be used with the system.
Table 5: Innovation in Design	ID Credits 1.2, 1.3, 1.4	Reward exceptional performance	1 point for each section	Rewards project teams for exceptional performance above the requirements set by the LEED-NC Green Building Rating System and innovative performance in categories not addressed by LEED. Requirements: A written proposal identifying the intent and requirements for compliance, submittals, and the design strategies to be applied for energy performance, water efficiency, and environmental and health benefits.	Because the FGS/PermaShine process involves dry grinding the concrete slab, disposal of messy, wet, and heavy slurry produced by older grinding methods is no longer an issue. Dry grinding also eliminates heavy water use and minimizes downtime. FGS/PermaShine needs fewer coats of chemical densifier. Look to earn Innovation in Design points using polished concrete in categories such as Water Efficiency or Sanitary/Recycled Byproduct.

MR Regional Materials Credit 5.1, 5.2

L&M Construction Chemicals Manufacturing Facilities: 500 Miles Radius



GENUINE
RECYCLED
PAPER



100% POST
CONSUMER
WASTE



Available exclusively from



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