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Polished Concrete AND LEED® v4.0 Certification

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Polished Concrete & LEED v4 Certification
L&M Construction Chemicals, Inc.

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Credits:

FGS/PermaShine Polished Concrete Floor Process
Prepared for L&M Construction Chemicals | LATICRETE International

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Table of Contents:

Section **Page**

Forward






This edition of the LEED v4 and Polished Concrete Floors white paper will cover the most significant changes in the LEED Green Building Rating System since the rating system was first released in 1999. The latest LEED v4 was released in November 2013 with new categories, prerequisites and credits. It requires unprecedented product ingredient scrutiny and transparency requirements, and a previously unrequired life-cycle perspective, especially, in regards to building products and their energy and environmental impacts. The new rating system offers project teams standards, acceptable third-party certifiers and identifies science-based measurement tools for assessing and verifying the sustainable attributes of building products.

The new emphasis on documenting material transparency and product life-cycle environmental impacts will be achieved through a "gut rehab" of the Materials and Resources category (which has always been the most product-oriented category in LEED). The MR Credits in LEED v4 have been renamed and the language within them contains new requirements. Generally, single product attributes such as recycled content and regional materials will remain important to LEED v4 project teams vs. teams seeking project certification under past versions of LEED. For this new version, however, they also will be tasked with selecting products from a life-cycle perspective, not just products with single sustainable attributes. The new MR Credits go beyond the product level and task project teams to source sustainable building assemblies and if possible the entire structure and its surroundings from a life-cycle perspective.

This significant shift in the assessment of green products may change how installations of Polished Concrete Floor Systems are measured for their energy and environmental impacts in LEED v4, but the overall positive impact of this type of floor system will carry over into the new version of the rating system. Indoor environmental quality, building reuse potential and the single product attributes are all among the single product attributes in which Polished Concrete Floors have a direct impact.

A Polished Concrete Floor System can assist project teams seeking certification of a green building project and how this flooring system does that will be covered in-depth within this white paper. An update on the relevant, new energy standard required by LEED in the energy performance prerequisites and credits will be discussed. A more significant change to LEED v4 in the Energy and Atmosphere category includes new LEED Credits designed to capture actual energy performance data, a task not previously required in earlier LEED certified projects.

The thermal mass of concrete foundational slabs and the resulting energy efficiency benefits of exposed interior concrete surfaces will be

important for compliance with the energy credits in LEED v4. The changes to the Thermal Comfort survey will be addressed as well. The Indoor Environmental Quality areas have been revised. Any LEED-point crossover potential will be explored and regional environmental priority benefits to polished concrete will be explained. Many of the changes in LEED v4 have already been or will be captured in new versions of the Collaborative for High Performance Schools (CHPS) rating system, Green Globes, The Living Building Challenge, the EnergyStar program, and some building codes including the California Green Building Standards Code (CALGreen). Since the LEED rating system is very similar to these other programs, which are both voluntary and mandated, the focus of this white paper will remain on LEED v4.

Background

Concrete construction makes environmental, social, and economic sense. Because polished concrete floors can have a beneficial impact on all three areas, polished concrete floors can literally and figuratively be the foundation for greener building.

According to the Department of Energy, commercial buildings in the United States consume 18% of our nation's energy and are responsible for 18% of the nation's carbon dioxide emissions. Furthermore, as reported during the Energy Programs Consortium presented in February 2008 in “Income, Energy Efficiency and Emissions: The Critical Relationship,” the residential building sector consumes 22% of our electricity and contributes 20% of our carbon emissions.

Building green is a good idea for more than environmental reasons. 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 annually through strategies that cut energy use by 30%. On 20,000 square feet, this can represent a savings of $50,000 or more in a five-year lease.

Exposed concrete in the interior of buildings enhances energy performance. Conservation of energy is the first and least expensive step toward an overall increase in a building's energy efficiency. As the building envelope is made more airtight through caulking and adding thermal and reflective insulation, the off-gassing of VOCs from a finished interior is more critical to monitor and mitigate because less fresh air from outside enters the building. Polished concrete helps mitigate the ways in which environmental quality can be negatively impacted in buildings that are lacking adequate fresh air ventilation. Concrete is inert. Polished concrete is a zero-VOC floor system.

Purpose

L&M Construction Chemicals commissioned Paul Nutcher, CSI CDT of Green Apple Group, LLC, to consider the potential LEED credits available to building teams when a polished concrete floor is included in the design and construction of new commercial buildings, including schools and core and shell projects.

There have been many new proposed versions of LEED v4. This white paper is based on the balloted version approved by a consensus of the USGBC membership in the summer of 2013. The new version of LEED v4 will also cover healthcare, retail, data centers, warehouses & distribution centers, hospitality and healthcare building types, which were not included in LEED v.3 (2009) rating system. Not all credits in both LEED versions are applicable to every building type. For example, LEED for Schools places more of an emphasis on acoustics, which might not be applicable in a LEED Core & Shell project.

Of the many green design strategies, this paper specifically addresses the role of a polished concrete flooring system in a high performance building. Polished concrete flooring, such as the FGS/PermaShine system, is an economical and aesthetically pleasing element within a building team's overall design strategy. Concrete surface treatments for floors are growing in popularity because these floor systems have many sustainable attributes.

An additional purpose of this white paper is to assist architects, specifiers, contractors and building owners seeking LEED Green Building Rating System points to certify their project while, at the same time, enhancing aesthetics and safety within a commercial interior with a polished concrete floor system.

The following documentation provides detailed information for building teams pursuing LEED certification of a building project through LEED-NC v.4. The benefits of pursuing LEED with polished concrete floor systems include improved thermal energy mass, the possibility of reusing existing building materials, and/or the inclusion of post-consumer recycled content and regional materials, among others.

USGBC, LEED and other Green Building Rating Systems

The realization that buildings needed to become more energy efficient and healthier for their occupants, coupled with a desire to reduce their impact on their surroundings, sparked the earliest stakeholders at the U.S. Green Building Council (USGBC) to take steps toward achieving more sustainable buildings. The USGBC is a non-profit coalition of building industry professionals who seek to improve the environmental impacts of buildings, campuses, and communities. The Council's first steps resulted in the Leadership in Energy and Environmental Design (LEED®) Green Building Rating System®. LEED measures a building's energy and environmental performance and has become the most widely recognized national rating tool for third-party verification of a sustainably designed, built, operated, and maintained building. LEED is a voluntary, consensus-based, national program that serves as an overlay to the building code for project teams seeking to exceed just-to-code design and construction practices.

It is important to note that there are other programs for measuring sustainability and building performance and polished concrete floor systems, including points toward compliance with LEED in buildings with polished concrete floors will also contribute points toward certification through most other rating systems, including the Collaborative for High Performance Schools (CHPS), Green Globes, Living Building Challenge, and Energy Star. In general, if points are applicable for LEED certification, they are usually available in other rating systems. The Green Globes National Green Building Ranking System is directly comparable to LEED-NC, and was developed by the Green Building Initiative (GBI), which awards Green Globes to buildings that have met its requirements for certification.

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

It is important to note that all of these systems rate green buildings only, and not products. The Energy Star and CHPS programs do maintain green product databases, unlike the USGBC. However, some of the new Materials and Resources categories in LEED list green product labeling schemes that can help project teams quickly identify single product attribute-tested products. Some product labeling programs, such as Cradle to Cradle certified products, can provide project teams with assistance in determining products that have undergone life cycle analysis for their energy and environmental impacts. Regardless of product labeling, building teams seeking LEED certification for their design strategies should consider the manufacturing process, materials, and the installation process of the specified building materials in order to obtain points toward certification.

LEED Version 4 (LEED v4)

In order to certify a green building, it takes an integrated project team gaining input from various disciplines related to the design, construction and operation of the proposed building. Therefore, meetings about the owner's requirements and the project's potential for LEED certification should all be determined during preliminary design phases and if possible prior to schematic design.

As the LEED certification process relates to polished concrete, the role of a polished concrete floor system needs to be part of the integrated design meetings because of its energy efficiency and its sustainable material properties and the overall reduced environmental impact of the flooring system during the life cycle of the building. Most polished concrete floors use the foundational slab and thus the system is part of the building envelope. There is also thermal mass to consider and concrete coloring for a reflective interior surface to take full advantage of natural light as a source of ambient lighting for the building interior.

This white paper covers LEED v4 for New Construction (NC) and Major Renovations, which has new categories, including some that a polished concrete floor can have an impact on but not all. The following is a list of all the categories:

1. Integrative Process (NEW)
2. Location and Transportation (NEW)
3. Sustainable Sites
4. Water Efficiency
5. Energy and Atmosphere
6. Materials and Resources
7. Indoor Environmental Quality
8. Performance (NEW)
9. Innovation In Design
10. Regional Priorities

"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."

Generally, LEED measures the environmental impact, water conservation and energy performance of buildings both locally and globally. The LEED family of green building rating systems contains requirements that list performance standards, many of which have become mandated by city and state governments and most federal agencies in building codes. The Government Services Administration (GSA), possibly the world's largest landlord overseeing courthouses, offices, federal agencies, and other U.S. government buildings, requires a LEED Silver certification level. In 2012, the GSA announced it would also permit its buildings to be certified under the Green Globes and Living Building Challenge programs. Furthermore, private sector landlords that want to rent space to the GSA must have certified their buildings to the LEED Silver level for both new construction and renovations to leased space, which would fall under LEED for Existing Buildings, Operations & Maintenance (LEED-EBOM) depending on the scope of the project.

A highest possible LEED score is 104 points in both the current and the new LEED rating systems. However, because of the unique elements of every building, it is highly unlikely a project could gain every potential point. Projects must achieve a minimum of 40 points in order to qualify for LEED certified status, 50 points to attain a silver certification, 60 points for gold, and 80 points for platinum. The LEED-EBOM rating system has many similar categories to the LEED-NC rating system although prerequisites, requirements and points required for certification differ.

The balloted and USGBC-member approved version of the LEED v4 was intended to be a Green Building Rating System for: New Construction and Major Renovations, Schools, Retail, New Construction, Data Centers, Warehouses & Distribution Centers, Hospitality, and Healthcare.

Before going for LEED v4, there are prerequisites in most categories except Location and Transportation (LT), Innovation in Design Process (IN), and Regional Environmental Priority (RP). The following LEED Prerequisites must be attainable or the project team cannot qualify for LEED certification of the building:

"L&M Construction Chemicals offers Vivid Dye coloration pigments and Quartzplate light-reflective pigmented floor hardeners which, in addition to being aesthetically pleasing, can contribute additional light reflectance properties and provide other possibilities to reduce electric lighting requirements."

Integrative Design (ID): Prerequisite:
- Integrative Project Planning and Design

Sustainable Site (SS): Prerequisites:
- Construction Activity Pollution Prevention
- Environmental Site Assessment

Water Efficiency (WE): Prerequisites:
- Outdoor Water Use Reduction
- Indoor Water Use Reduction
- Building-Level Water Metering

Energy and Atmosphere (EA): Prerequisites:
- Fundamental Commissioning and Verification
- Minimum Energy Performance
- Building Level Energy Metering
- Fundamental Refrigerant Management

Materials and Resources (MR): Prerequisites:
- Storage and Collection of Recyclables
- Construction and Demolition Waste Management Planning
- PBT Source Reduction-Mercury

Indoor Environmental Quality (EQ): Prerequisites:
- Minimum Indoor Air Quality Performance
- Environmental Tobacco Smoke Control
- Minimum Acoustic Performance/Schools

A LEED-NC v4 registered project must meet and exceed ASHRAE 90.1-2010 to meet the Energy and Atmosphere (EA) Prerequisite. Once the base level prerequisites for the energy systems are met, the higher

the percentage of energy optimization the building is designed to achieve, the more points it will earn in AE Credit 1: Optimized Energy Performance. This white paper will dig deeper into the AE Credit 1 later in the document.

Other AE Prerequisites require the energy system to be commissioned by a third-party to verify the performance of the HVAC system and there cannot be any CFCs in the cooling system. There must also be Building Level Energy Metering. The requirements of the LEED prerequisites will be fully detailed in the LEED Reference Guide.

The LEED Energy and Atmosphere category represents the single largest point gathering category, due to the importance of energy efficiency. Here polished concrete can contribute numerous advantages due to its thermal storage potential and potential for leveling heating and cooling loads. It is important, therefore, to advise the project team to include the thermal mass properties of interior exposed concrete in the overall energy modeling calculations to gain the most accurate projected energy performance of the building.

With a polished concrete floor system, there is also the potential for building occupants to enjoy greater thermal comfort as a result of the polished concrete floor leveling ambient air temperatures. The measuring of Thermal Comfort is categorized under Indoor Environmental Quality (EQ) in LEED.

Polished Concrete Flooring in LEED v4 Certified Projects

The first step to understanding how polished concrete floors can enhance a high-performance building project is to examine the USGBC program and note how a polished concrete flooring system, such as the FGS/PermaShine system, can help the project team achieve its goal of obtaining LEED certification.

Polished concrete floor systems can potentially contribute points within several of the LEED-NC rating system categories. The dry-applied polished concrete process and concrete floors in general can theoretically contribute at least five points toward LEED-NC certification. However, because the process of pursuing LEED certification results in synergies and trade-offs that can interconnect several LEED Credits across two or more LEED Categories, the FGS/PermaShine system could indirectly contribute toward more LEED points.

As stated above, before the building team can earn LEED certification, it must meet the Prerequisites and enough points within the LEED Credits to gain certification. This white paper will describe how the FGS/PermaShine family of products assists project teams with the requirements for attaining the following Credits in LEED-NC v.4 registered projects while noting potential assistance in meeting the prerequisites.

Polished Concrete Flooring Systems Contribution to LEED-NC v.4 Certification

IP Credit 1: Integrative Process (1 point)

There is a new credit category for rewarding project teams for utilizing an Integrative Process for the design and construction and maintenance of a building. The IP category contains a new Prerequisite, which is mandatory for all healthcare projects, and a new credit entitled *Integrative Process*, which rewards project teams with a point toward LEED certification if they can meet the credit's requirements.

The Integrated Process credit is started by the project team at the development of schematic design, which must include documentation of at least two building system synergies as a requirement for gaining points in this category. Another requirement is a discovery integrated design workshop with the goal of developing synergies through the following best practices:

- energy modeling;
- habitat well-being assessment;
- site assessment for environmental, agricultural, storm water, and human impacts;
- water conservation; and
- daylighting.

At the initial design charette, the Owners Product Requirements (OPR) document must be developed with a human health mission statement address in the social, economic and environmental goals of the project; the OPR document must include benchmarks and a project timeline. The level of LEED certification (Silver, Gold, Platinum) goal is set. And, the session must include at least four members of the project team, plus an owner or owner representative.

The idea behind this credit is to bring all the project's disciplines and trades to the table early in the design phase and look for ways to integrate efforts and cost effective strategies and techniques for achieving goals that nurture human health, conserve energy and resources, and reduce environmental impacts. The charette also must determine the members of the trades responsible for helping to achieve each LEED credit needed to gain the level of certification set as the goal in the OPR.

A project team can enhance its synergies with interior concrete surface treatments due to the high reflectance available with a polished concrete floor and the resulting lower initial outlay for overhead lighting systems as well as the long-term energy savings due to less ambient lighting needs. Further, in structures with appropriate glazing systems to enhance the flow of sunlight throughout the interior, polished concrete can enhance a design for daylighting.

The LCA requirement of buildings for a reduced energy and

environmental impact is also first mentioned in the IP category and fully explored later in the rating system's Materials and Resources category. Because polished concrete lasts for the lifespan of the building's foundation (with the potential for periodic regrinding to restore the slab to its original level and condition), a building envelope comprising concrete construction assemblies could score better in the LEED rating system than other flooring options.

Energy and Atmosphere (AE)

Energy and Atmosphere (EA)

The Energy and Atmosphere category has new available credits developed to ensure the planned energy performance of the building at LEED certification is the same performance encountered by the occupants and the building owner over time. This is a change that reflects an emphasis by the USGBC to make sure a building's improved energy performance actually happens beyond the planning stages of the project.

Demand Response (also called Energy Curtailment) is one of the new credits within this category and is designed to foster a reduction in energy demand during peak hours. Contained in the changes to Energy and Atmosphere, as well as the new Performance category, are opportunities for projects using polished concrete to retain and even expand possible credits toward LEED certification.

There is also a new requirement in the commissioning prerequisite that the building envelope be commissioned. Again, the thermal mass of a polished concrete floor would fare better during commissioning for an easier time passing testing and verification benchmarks, especially compared to a wood or metal frame construction. It would also assist in the new Demand Response credit because a polished concrete floor system can level peak demand for energy by a building's heating and cooling system due to its thermal mass.

EA Credit 1: Optimize Energy Performance, 1-20 points

The intent of this LEED credit is to design a heating and cooling system, building envelope, and lighting system that will outperform the baseline energy performance for the building, as it was calculated during the process of complying with LEED EA Prerequisite 2, Minimum Energy Performance.

In order to meet the prerequisite, the building team must have designed the building to comply with both the mandatory provisions of ASHRAE/IESNA Standard 90.1-2010 and the Prescriptive Requirements of 90.1 or the Section 11 Performance Requirements of

Energy and Atmosphere (AE) ...continued

90.1 (without amendments) or the requirements of the local energy code - whichever criteria is more rigorous. LEED points for EA Credit 1: Optimize Energy Performance are gained for every 2 percentage points higher the building's energy system performs above the building's energy performance baseline calculated in compliance with the prerequisite.

Utilizing the thermal properties of a concrete floor system with the FGS/PermaShine system can be part of a whole building approach to maximize a building's energy efficient design and reduce the cooling and heating loads. The polished concrete floor system can enhance the foundational slab of the building envelope, reduce heating and cooling loads on the HVAC system, and reduce lighting requirements.

A reduction in the number of lighting units often can be achieved above a polished concrete floor because of the reflective properties of the FGS/PermaShine floor system. L&M Construction Chemicals offers Vivid Dye coloration pigments and Quartzplate light-reflective pigmented floor hardeners which, in addition to being aesthetically pleasing, can contribute additional light reflectance properties.

The gloss and coloration of polished concrete floors can also assist building teams designing the building to maximize the natural light entering a building, often referred to as a "daylighting strategy." Because a polished concrete floor system can enhance the visible light transmittance levels from skylights and windows, FGS/PermaShine can assist with EQ Credit 8.1: Daylight and Views – Daylight.

Be aware that for a concrete slab to contribute to daylighting, a white cement or shake-on pigment with high light reflectance properties can be applied for a less expensive approach. Or, 28 days after the pour, acetone or water-based concrete coloring systems can be applied. The high-gloss polished concrete slab, once in place, bounces both natural and artificial light around the occupied space for the life span of the building as long as the concrete floor remains treated, maintained and exposed. The reflective characteristic of the polished concrete floor can be captured with tools for measuring its Solar Reflective Index (SRI) to comply with the requirements in the relevant LEED credits.

Because installing fewer light fixtures means less electricity will be used, improving the reflectivity of the floor system saves on initial costs and reduces long-term energy needs. Reduced electricity demands helps reduce the amount of fossil fuel burned in the production of electricity -- or the number of on-site photovoltaic panels needed in distributed energy generation systems.

Human health and economics can be improved with enhanced daylighting strategies. Studies have shown that boosting natural light in

interiors, contributes to a measurable improvement in the building occupants' quality of life. Increased interior natural light correlates to increased positive outcomes for hospital patients, stronger retail sales numbers, higher test scores in academic institutions, and improved productivity for workers in office environments.

Materials and Resources

While the other existing categories in LEED will not experience tremendous alterations, the revised Materials and Resources category will gain new prerequisites and new credits, which have absorbed many of the credits in past versions of LEED. These new prerequisites are MR Prerequisite 2, Construction Demolition Debris Management Planning, and, for healthcare projects, MR Prerequisite 3, PBT Source Reduction-Mercury, which requires project teams to eliminate medical devices containing heavy metals.

Indeed, Materials and Resources is the most overhauled category, especially from a building materials and product manufacturer's perspective. Design professionals will have to relearn the requirements for credit compliance in order to gain points toward certification. Several credits are new and others have been eliminated in an attempt to reward LEED project teams for specifying materials on a lifecycle basis rather than just a single sustainable attribute. In fact, products that once contributed to single LEED credits—such as recycled content and regional content—their green attributes will contribute to options within the new materials and resources credits.

Of the Materials and Resources credits, this white paper will examine those relevant to a Polished Concrete Floor System. Those credits include:

- MR Credit 1: Building Life Cycle Impact Reduction
- MR Credit 2: Building Product Disclosure and Optimization – Environmental Product Declarations
- MR Credit 3: Building Product Disclosure and Optimization – Sourcing of Raw Materials
- MR Credit 4: Building Product Disclosure and Optimization – Material Ingredients

All four of these credits are seeking what the USGBC has stated in its three years of development of LEED v4; the new rating system requires greater transparency from materials and product manufacturers selected for LEED projects and requires a life-cycle approach by the project team to develop a more sustainable building. This includes using a more holistic approach with consideration of a building's components and materials, paying special attention to their energy and water usage, and overall environmental impacts.

MR Credit 1: Building Life Cycle Impact Reduction (1-6 Points)

This credit for Building Life Cycle Impact Reduction is available to project teams working on LEED NC projects. In previous versions of LEED, this credit was achieved through adaptive reuse of an existing building and the reuse of a significant portion of existing building materials and assemblies. There are several OPTIONS for meeting the requirements of the new MR Credit 1.

Embodied in these OPTIONS are rewards for incorporating single product attributes, such as recycled content, regional materials and other common green product attributes into the project; however, unlike LEED v3, single product attributes are not rewarded with points. Again, this is the way LEED v4 rewards holistic approaches to sourcing and installing sustainable products.

Due to the restorative nature concrete polishing provides a foundational slab, a rehabbed exposed concrete surface through this process would satisfy the requirements for obtaining points toward LEED v4 certification in three of the four OPTIONS within LEED v4 MR Credit 1.

OPTION 1, Historic Building Reuse (5 points BD&C, 6 points Core and Shell)

LEED v4 MR Credit 1 has several options for meeting the requirements, including the reuse or renovation to historic buildings in OPTION 1. The requirements are to maintain the existing structure, envelope and interior nonstructural elements of a historic building listed in a register of historic places.

Since most buildings historic or otherwise have a foundational slab and it comprises a large portion of the structural building envelope, its reuse for a Polished Concrete Floor System can assist project teams in gaining points within this LEED credit under OPTION 1.

OPTION 2, Renovation of Abandoned or Blighted Building (5 points BD&C, 6 points Core and Shell)

OPTION 2 addresses abandoned buildings without the historic designation and requires preservation of at least 50 percent by surface area of the existing building structure, enclosure and interior structural elements. In this OPTION, the building to be renovated must meet local criteria of abandoned or blighted. Since a polished concrete floor is applied to the foundational slab, it can assist a LEED project team in gaining points toward certification because the foundation slab comprises a large portion of most existing buildings.

OPTION 3, Building and Material Reuse (1-4 points BD&C, 1-5 points Core and Shell)

OPTION 3 does not apply to Polished Concrete Floor Systems as it requires a financial transaction for used or salvaged building materials and products that come from offsite.

OPTION 4, Whole Building LCA

In OPTION 4, the credit seeks to reward project teams willing to conduct a Whole Building LCA to determine its reduced impact on the environment. The project team must demonstrate a 10 percent reduction in at least three of six potential environmental impacts through an LCA of the building's structural and enclosure assemblies. None of the environmental impacts are permitted to increase by more than 5 percent compared with the reference building.

While full information on the requirements for earning point(s) in OPTION 4 are still pending, it is expected this credit will rely on the Athena Eco-Calculator for calculating and comparing the various material assemblies from a life-cycle assessment (LCA) perspective.

LEED treats a polished concrete floor as a portion of the building envelope system or assembly because labor and chemicals are applied to a foundational slab in order to produce a Polished Concrete Floor System. Furthermore, concrete is the main component of the assembly and its Life Cycle Assessment can be favorable over a 75 year building life span.

To meet the requirements of this credit, the design team produces an impact score sheet for the assemblies assessed and those results are plugged into the LEED LCA Credit Calculator to generate the potential LCA score and meet the credit requirements.

To comply with this OPTION, the project team must assess three of the following impact measures for reduction:

- global warming potential (greenhouse gases), in CO2e;
- depletion of the stratospheric ozone layer, in kg CFC-11;
- acidification of land and water sources, in moles H+ or kg SO2;
- eutrophication, in kg nitrogen or kg phosphate;
- formation of tropospheric ozone, in kg NOx or kg ethane; and
- depletion of nonrenewable energy resources, in MJ.

The Global Warming Potential (GWP) has to be one of the impacts measured. The most well-known cost-effective LCA calculator for building assemblies for AEC professionals is the Athena Institute's Impact Calculator (http://www.athenasmi.org/our-software-data/impact-estimator/). Check the LEED Reference Guide for further details on how to utilize the Athena Institute's Impact Calculator. An LCA can show that a Polished Concrete Floor System can reduce the

environmental impact of buildings in the maintenance and replacement schedules, especially compared to other flooring products and especially in major renovations of older buildings covered by the credits in this category of LEED v4.

Furthermore, the life cycle benefits of concrete construction materials have been studied intensely in recent years leading up to the anticipated release of LEED v4. In these published studies, concrete provides many environment benefits that will enable project teams to earn points toward LEED v4 certification. The following from the National Ready Mix Concrete Association - NRMCA, Life Cycle Assessment of Concrete Buildings, By Lianal Lemay, P.E. LEED AP, Sr. VP, Sustainable Development, NRMCA) provides a summary of many of those benefits, including:

"…the production of concrete is resource efficient and the ingredients require little processing. Most materials for concrete are acquired and manufactured locally, which minimizes transportation energy and associated greenhouse gas emissions. Concrete incorporates recycled industrial byproducts such as fly ash, slag and silica fume which helps reduce embodied energy, carbon footprint and waste. Concrete has a long service life, thereby increasing the period between repair and maintenance and associated environmental impacts. … Most importantly, because of concrete's thermal mass, concrete buildings can be extremely energy efficient. From a life cycle perspective, concrete-frame buildings perform well when compared to steel-frame buildings. As a result, concrete buildings have lower carbon footprint over their entire life cycle."

While there is energy involved in the mining, extraction, transportation and manufacturing of products, and the end of life demolition of buildings, the most energy intensive period of time over a building's lifespan is usually during occupancy and operations. The operations and maintenance phase of a building is the time that a Polish Concrete Floor System excels from an environmental standpoint. Lemay noted that the operational period of time for a building typically has 5 to 20 percent greater impact on the environment depending on the use of the building compared to the impacts during manufacturing and demolition.

MR Credit 2: Building Product Disclosure and Optimization – Environmental Product Declarations

The USGBC wants to reward project teams that have sourced products and materials that have undergone an LCA and have been determined to have environmentally, economically and socially preferable life-cycle impacts. This credit requires such sourcing.

OPTION 1, Environmental Product Declarations (1 point)

The project team must use at least 20 different permanently installed products sourced from at least five different manufacturers that meet specific disclosure criteria as determined by the USGBC to earn this credit.

Very few, if any, manufacturers of the products used for preparing and finishing a polished concrete floor have produced Environmental Product Declarations (EPD) at this time; however, a Polished Concrete Floor System with its ingredients assessed for their energy conservation characteristics and environmental impacts would likely show a reduced impact in the areas reported in the EPD.

This next credit requires project teams to source products that have undergone a life-cycle assessment. Unlike whole building LCAs called for in other credits, product manufacturers are to follow the guidelines for product-specific EPDs in ISO 14044 from a minimum cradle-to-gate scope as ¼ of a product for the purposes of credit achievement calculation. The EPD must also have been third-party verified by approved programs.

A second type of EPD, which conforms to ISO 14025, 14040, 14044, and EN 15804 or ISO 21930 and has at least a cradle-to-gate scope, must be submitted by project teams. They can be produced by an industry group for products with third-party certification (Type III), including external verification, in which the manufacturer is explicitly recognized as a participant by the program operation, and they are valued as 1/2 of a product for purposes of credit achievement calculation.

The USGBC is set to publish approved programs for compliance with this credit for products that comply with other USGBC approved environmental product declaration frameworks.

OPTION 2, Multi-Attribute Optimization (1 point)

Products must be sourced with one of the criteria below for 50%, by cost of the total value of all the permanently installed products in the project. The value of the product is based on the following:

- Third-party certified products that reduce impacts in three of the impact measures below compared to the industry average are valued at 100 percent of their cost for credit achievement calculations.
  - global warming potential (greenhouse gases), in CO2e;
  - depletion of the stratospheric ozone layer, in kg CFC-11;
  - acidification of land and water sources, in moles H+ or kg SO2;
  - eutrophication, in kg nitrogen or kg phosphate;
  - formation of tropospheric ozone, in kg NOx or kg ethane; and
  - depletion of nonrenewable energy resources, in MJ.

Again, the USGBC is also set to publish approved programs for compliance with this credit, for products that comply with other USGBC approved environmental product declaration frameworks.

Just as project teams were rewarded for sourcing products via a Regional Materials credit in LEED v3-2009, this OPTION within the new version encourages local sourcing. However, the radius from the construction site for extraction, manufacturing and purchasing of the product has been reduced to within a 100 mile radius of the construction site (by comparison to 500 miles in the previous version of LEED). And lastly, the structure and enclosure assemblies cannot constitute more than 30 percent of the value of the compliant building products.

MR Credit 3: Building Product Disclosure and Optimization – Sourcing of Raw Materials

This new credit in LEED v4 is again asking project teams to source products with Life Cycle data that has been third-party verified or self-declared reports from the manufacturer. Unlike the previous credits, this credit seeks products with ingredients that have been mined, extracted or sourced in an environmentally and socially responsible way.

Option 1. Raw Material Source and Extraction Reporting (1 point)

The project team must install a minimum of 20 products from at least five different manufacturers that have public documentation identifying their raw material suppliers that include:

> "raw material supplier extraction locations, a commitment to long-term ecologically responsible land use, a commitment to reducing environmental harms from extraction and/or manufacturing processes, and a commitment to meeting applicable standards or programs voluntarily that address responsible sourcing criteria."

While third-party verified corporate sustainability reports (CSR), which include environmental impacts of extraction operations and activities associated with the manufacturer's product and the product's supply chain, are valued as one whole product for credit achievement calculation.

The USGBC will accept the following CSR frameworks:

- Global Reporting Initiative (GRI) Sustainability Report
- Organization for Economic Cooperation and Development (OECD) Guidelines for Multinational Enterprises
- UN Global Compact: Communication of Progress
- ISO 26000: 2010 Guidance on Social Responsibility
- USGBC approved program: Other USGBC approved programs meeting the CSR criteria.

Option 2. Leadership Extraction Practices (1 point)

Use products that meet at least one of the responsible extraction criteria below for at least 25%, by cost of the total value of permanently installed building products in the project.

Extended producer responsibility. Product purchased from a manufacturer (producer) that participates in an extended producer responsibility program or is directly responsible for extended producer responsibility. Products meeting extended producer responsibility criteria are valued at 50% of their cost for the purpose of credit achievement calculation.

Bio-based materials. Bio-based product must meet the Sustainable Agriculture Network's Sustainable Agriculture Standard. Bio-based raw materials must be tested using ASTM Test Method D6866 and be legally harvested, as defined by the exporting and receiving country. Exclude hide products, such as leather and other animal skin material. Products meeting bio-based materials criteria are valued at 10% of their cost for the purposes of credit achievement.

Wood Products. Wood Products must be certified by the Forest Stewardship Council or USGBC-approved equivalent. Products meeting wood product criteria are valued at 100% of their cost for the purposes of credit achievement calculation.

Materials reuse. Reuse includes salvaged, refurbished, or reused products. Products meeting materials reuse criteria are valued at 100% of their cost for the purposes of credit achievement calculation.

Recycled content. Recycled content is the sum of postconsumer recycled content plus one-half the pre-consumer recycled content, based on cost. Products meeting recycled content criteria are valued at 100% of their cost for the purposed of credit achievement calculation.

Adding fly ash to concrete is considered to be a green practice and can enhance the recycled content of a Polished Concrete Floor System because it recycles fly coal ash from local power plants. In fact, fly ash can replace up to 30 percent of the Portland cement normally used. However, it is typically best to only include 15 percent fly ash in concrete for a slab-on-grade that will receive polished concrete surface treatment, so as not to interrupt the chemistry of the concrete hardener. Fly ash improves the performance, quality, and plastic properties but it must conform to the requirements of ASTM C 618, Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Us in Concrete, for Class C or F used as a mineral admixture.

USGBC approved program. Other USGBC approved programs meeting leadership extraction criteria.

For credit achievement calculation, products sourced (extracted, manufactured, purchased) within 100 miles (160 km) of the project site are valued at 200% of their base contributing cost. For credit achievement calculation, the base contributing cost of individual products compliant with multiple responsible extraction criteria is not permitted to exceed 100% its total actual cost (before regional multipliers). Double counting of single product components compliant with multiple responsible extraction criteria is not permitted and in no case is a product permitted to contribute more than 200% of its total actual cost.

Structure and enclosure materials may not constitute more than 30% of the value of compliant building products.

MR Credit 4: Building Product Disclosure and Optimization – Material Ingredients, 1-2 points

This credit attempts "to reward project teams for selecting products for which the chemical ingredients in the product are inventoried using an accepted methodology and for selecting products verified to minimize the use and generation of harmful substances." Further reward is available to manufacturers who produce third-party verified life-cycle impact documentation.

Option 1. Material Ingredient Reporting (1 point)

The project team must select at least 20 different permanently installed products from at least five different manufacturers that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1 percent (1,000 ppm).

Manufacturer Inventory. The manufacturer has published complete content inventory for the product following these guidelines:

- A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
- Materials defined as trade secret or intellectual property may withhold the name and/or CASRN but must disclose role, amount and GreenScreen benchmark, as defined in GreenScreen v1.2.
- Health Product Declaration. The end use product has a published, complete Health Product Declaration open Standard.
- Cradle to Cradle. The end use product has been certified at the Cradle to Cradle v2 Basic level or Cradle to Cradle v3 Bronze level.
- USGBC approved program. Other USGBC approved programs meeting the material ingredient reporting criteria.

AND/OR

Option 2: Material Ingredient Optimization (1 point)

Use products that document their material ingredient optimization using the paths below for at least 25 percent by cost of the total value of permanently installed products in the project.

GreenScreen v1.2 Benchmark. Products that have fully inventoried chemical ingredients to 100 ppm that have no Benchmark 1 hazards:
If any ingredients are assessed with the GreenScreen List Translator, value these products at 100 percent of cost.
If all ingredients have undergone a full GreenScreen Assessment, value these products at 150 percent of cost.

- Cradle to Cradle Certified. End use products are certified Cradle to Cradle. Products will be valued as follows:
- Cradle to Cradle v2 Gold: 100 percent of cost
- Cradle to Cradle v2 Platinum: 150 percent of cost
- Cradle to Cradle v3 Silver: 100 percent of cost
- Cradle to Cradle v3 Gold or Platinum: 150 percent of cost

International Alternative Compliance Path – REACH Optimization. End use products and materials that do not contain substances that meet REACH criteria for substances of very high concern. If the product contains no ingredients listed on the REACH Authorization or Candidate list, value at 100% of cost.
USGBC approved program. Products that comply with USGBC approved building product optimization criteria.
AND/OR

Option 3: Product Manufacturer Supply Chain Optimization (1 point)

Use building products for at least 25 percent by cost of the total value of permanently installed products in the project that:

- Are sourced from product manufacturers who engage in validated and robust safety, health hazard and risk programs which at a minimum document at least 99% (by weight) of the ingredients used to make the building product or building materials, and
- Are sourced from product manufacturers with independent third party verification of their supply chain that at a minimum verifies:
- Processes are in place to communicate and transparently prioritize chemical ingredients along the supply chain according to available hazard exposure and use information to identify those that require more detailed evaluation
- Processes are in place to identify, document, and communicate information on health, safety and environmental characteristics of chemical ingredients
- Processes are in place to implement measures to manage the health, safety and environmental hazard and risk of chemical ingredients.

Indoor Environmental Quality (EQ)

As architects design energy-efficient buildings with greater air tightness, they want fresh air ventilation and products that enhance indoor air quality. FGS/PermaShine products do not contribute to mold growth, do not off-gas VOCs after installation, and have a positive effect on indoor environments.

The thermal mass of a Polished Concrete Floor System plays a role in this category of LEED also within the Thermal Comfort credit. Buildings designed to maintain a comfortable temperature promote worker and student productivity as well as the health of occupants.

EQ Credit 2: Low-Emitting Materials (1-3 points)

This credit seeks to reduce human exposure to volatile organic compounds (VOCs) while providing project teams with appropriate test methods to determine the levels of VOCs. Different materials must meet different requirements in order to comply with this credit. In all, there are six categories to be assessed, but since Polished Concrete is an interior product for flooring it would be required to meet the VOC minimum standards of emissions and content requirements within the flooring category.

The chemical ingredients for a polished concrete floor are compliant with the California Department of Public Health (CDPH) Standard Method V1.1-2010, Section 8. If the polished concrete floor is tinted, those chemicals also must be CDPH-compliant.

The main ingredient for hardening concrete during the polished process is sodium silicate, which is an active compound found in common household laundry detergent. Lithium silicate used as a densifier is also used by polished concrete contractors and provides the same results. The installer can take two to seven steps to finish the polished concrete floor, depending on variables such as how flat the floor is and the chemicals applied.

Many concrete coloration systems used on a cured slab before the surface hardening step are now water based. Still, some can contain VOC-exempt acetone present only during color application and the chemical evaporates within minutes of spraying so they comply with South Coast Air Quality Management District (SCAQMD) Rule #1113, Architectural Coatings (January, 2004). These construction chemicals for interior concrete surface treatments easily complied when subjected to the test methods in the CDPH Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-scale Environmental Chambers, including 2004 Addenda.

L&M Construction Chemicals tested its densifers and other products within the FGS-PermaShine family of products at Berkeley Analytical

Environmental Testing Laboratory, which is ISO/IEC 17025 accredited lab. The beneficial test results meet the General Emissions Evaluation requirement in LEED. Furthermore, the LEED v4 Credit for Low-Emitting Materials considers concrete, which is overwhelmingly the largest portion of the Polished Concrete Floor System, to be an "Inherently Non-emitting Source."

The range of total VOCs within the products are compliant per CDPH Standard Method v1.1 and therefore meet or exceed the LEED requirements of:

- 0.5 mg/m3 or less;
- Between 0.5 and 5.0 mg/m3; or
- 5.0 mg/m3 or more.

International project teams may use testing in accordance with the German AgBB Testing and Evaluation Scheme (2010). The FGS-PermaShine family of products also complies with the additional VOC content requirements of LEED v4 for wet-applied products, for the health of the installer and other contractors who are exposed to these products.

Four products manufactured by L&M Construction Chemicals that are used to install and/or maintain a polished concrete floor have successfully passed the Berkeley Analytics laboratory tests indicating their levels of emissions of volatile organic compounds (VOCs) are well below accepted standards within the LEED rating system. The four products include: FGS® Hardener Plus™, SEAL HARD™, VIVID Dye™ and FGS® Concrete Conditioner.

These products are listed in the Collaborative for High Performance Schools (CHPS) Best Practices Manual, 2006, Low-Emitting Materials Table. L&M Construction Chemicals and the Berkeley Analytical both have certified the products meet the CHPS Low-Emitting Materials criteria Section 01350 for use in classrooms. In addition to building occupants, the FGS/PermaShine process can reduce the quantity of indoor air contaminants for the comfort and well-being of installers.

The chemical treatments in FGS/PermaShine densifiers are VOC-free and comply with SCAQMD Rule #1168. The L&M Vivid Dye concrete dye for building projects that specify a color scheme does not contribute to smog and therefore is VOC exempt. The acetone present during the application of Vivid Dye evaporates within minutes of spraying.

EQ Credit 5: Thermal Comfort – Design (NC, Schools, CS: 1 point)

To comply with this LEED Credit, the design team must design the HVAC and building envelope to ASHRAE Standard 55-2010, Thermal

Comfort Conditions for Human Occupancy. A LEED registered school has the additional requirement that natatoriums comply with "Typical Natatorium Design Conditions defined in Chapter 4 (places of Assembly) of the ASHRAE HVAC Applications Handbook, 2011 edition. Or, the HVAC system design must meet the requirements of the applicable standard:

- ISO 7730:2005 Ergonomics of the Thermal Environment, analytical determination and interpretation of thermal comfort, using calculation of the PMV and PPD indices and local thermal comfort criteria; and
- CEN Standard EN 15251:2007, Indoor Environmental Input Parameters for Design and Assessment of Energy Performance of Buildings, addressing indoor air quality, thermal environment, lighting, and acoustics, Section A2.

Occupied areas of data centers, warehouses and distribution centers must meet the above requirements. For the storage, sorting and distribution areas that are occupied, one or more of the following design alternatives are acceptable:

- Radiant flooring
- Circulating fans
- Passive systems, such as nighttime air, heating venting, or wind flow;
- Localized active cooling (refrigerant or evaporative-based systems) or heating systems; and
- Localized hard-wired fans that provide air movement for occupants' comfort.
- Other equivalent thermal comfort strategy.

The project team must also provide occupants with thermal comfort controls for at least 50% of individual occupant spaces and for all shared spaces. Hotel rooms are not included in this requirement and only office space in a retail setting are included. Every hospital room must have individual thermal comfort controls for its patients. In all types of buildings thermal comfort controls can provide occupants the ability to adjust air temperature, radiant temperature, air speed of fans and/or humidity levels.

The benefit of thermal storage in concrete construction with a Polished Concrete Floor System can be a benefit to project teams attempting the requirements within this LEED v4 Credit. The HVAC system (or passive heating and cooling system) can be designed to take into account the thermal mass properties of a foundational slab. The mechanical or passive heating and cooling systems affect environmental conditions such as air temperature, radiant temperature, relative humidity and air speed throughout the conditioned space to enhance occupant comfort. The foundational slab also affects one or more of these environmental conditions through thermal transfer of the

heat, including the storing of occupants' body temperature and heat from sun light stored in the concrete mass as well as other factors.

Passive solar heating can be achieved with careful consideration of building placement on the site and the appropriate glazing systems allowing sunlight to warm the exposed concrete portions of the interior. In some passive heating and cooling systems, design teams often rely on night time cooling through operable skylights or windows for a more energy efficient means of achieving thermal comfort for occupants. Overall, an exposed, surface treated concrete floor levels the heating and cooling loads providing a more comfortable environment for occupants.

Innovation in Design

Innovation in Design (ID)

Innovation in Design credits are available to projects that are designed to perform beyond the current benchmarks in the LEED v.3.0. Project teams can achieve points in ID Credits through innovation, pilot credits or exemplary performance. Project teams can consider the following Innovation in Design LEED Credits with the FGS/PermaShine system:

The USGBC warns that an ID Credit awarded on one project does not mean that a second ID Credit will be awarded on a subsequent project. Still, FGS/PermaShine could potentially assist with one or possibly all of the available points in that ID Credit Category.

ID/EA Credit 1:
Optimize Energy Performance (NC, Schools, CS 1 point)

For projects that can demonstrate a percentage improvement in the optimized energy performance of the building compared to the baseline building performance rating per ASHRAE 90.1-2007 by the following minimum energy cost savings percentages will be considered for 1 additional point in the Innovation and Design category:

- New Buildings 50%
- Existing Buildings Renovations 46%

ID/MR Credit 3: Material Reuse:
15% (NC & Schools 1 point), 10% (CS 1 point)

Project teams may earn an Innovation in Design credit for exemplary performance by maintaining 95% or more of the existing walls, floors and roof.

ID/MR Credit 4: Recycled Content:
30% (post-consumer + 1/2 pre-consumer)

Project teams may earn an ID Credit for exemplary performance for 30% recycled content (based on cost) of the total value of the materials in the project.

ID/MR Credit 5: Regional Materials: 30% (NC, Schools, CS: 1 point)

For an ID Credit for Regional Materials, the building products must be extracted, harvested or recovered, as well as processed and manufactured, all within 500 miles of the project site for a minimum of 30% (based on cost) of the total materials value used during construction.

ID Credit 4: LEED Accredited Professional

The project team can anticipate this ID Credit if a LEED Accredited Professional is one of the principle participants on the project team. The intent of this credit area is to support and encourage the design integration required by a LEED-NC green building project and to streamline the application and certification process.

Regional Environmental Priorities

REP Credit 1-4: Regional Environmental Priorities (NC, Schools, CS, 1-4 points)

Regional Priority LEED Credits were introduced in LEED 2009 for project teams to address geographically specific environmental priorities. This new concept does not create additional LEED credits, but assigns more weight to existing credit(s) that address regional issues.

The LEED project administrator enters the zip code of the building site and can choose to address up to four of the region's environmental priorities. There are lists of Regional Priority LEED Credits for the 50 U.S. states, District of Columbia and Puerto Rico. FGS/PermaShine improves energy and environmental performance and therefore can help project teams add points for addressing Regional Priority LEED Credits, especially MR Credit 2, Construction Waste Management, which is a priority in nearly all regions.

**Visit www.usgbc.org for full details.*

More on Innovation in Design Credits

L&M Construction Chemicals developed a family of polished concrete products, providing design teams with the opportunity for LEED points within the Innovation in Design Credit Category of LEED.

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

This vacuum-captured byproduct can be collected in 20 pound bags and reused as aggregate for concrete or 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 than the first-generation of Polished Concrete Floor Systems, which require heavy water use, wasteful and repeated coats of a densifier, producing a wet, heavy slurry that is difficult to dispose of. This slurry has a potentially negative proposition for building teams, which have compliance issues with the Environmental Protection Agency. The slurry cannot simply be washed down a sanitary sewer. A work site that generates slurry also has to be anticipated, and time and costs for floor re-surfacing preparation are also a large factor in project costs and time with the earlier Polished Concrete Floor Systems.

The Future of Green Building Rating Systems

In launching LEED v4, the USGBC has raised the bar higher in exponential ways for building project teams. The USGBC and several partner industry organizations and the appropriate public sector representatives have taken the step toward positioning LEED to be programs for Net Zero Energy buildings and restorative architecture.

The USGBC, 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, and the US Department of Energy, are among the partners striving to cut the energy usage and environmental impacts of buildings. Furthermore, many jurisdictions across the country have included stricter energy requirements and green building practices in their latest building codes.

So it is no surprise that the growth in design, construction and operation of green or high performance buildings is expected to increase exponentially in the coming decades. The LEED Green Building Rating System as well as other third-party certification programs will likely guide this evolution with specific guidelines. It is also accepted that all stakeholders within the architectural community who stay current on the trend will gain strong footholds within the industry, leaving others unwilling to change behind. In other words, changes in the marketplace will create new opportunities for those who embrace, understand and respond to these changes.

DISCLAIMER:

The enclosed LEED v4 for Green Building Design and Construction Green Building Rating System credit references are suggestions as to where FGS/PermaShine products may apply in earning points for LEED registered projects. LEED certification is granted to projects, not products by a panel at the U.S. Green Building Council; however, the products and processes employed on LEED registered projects impact the achievement of LEED certification and the level attained. The LEED applicant is responsible for determining the product attributes that will help provide LEED certification of a building.

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 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 or
www.fgs-permashine.com.

Notes:

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

fgsPermaShine polished concrete

LEED v4 is for Building Design and Construction of the following building project types: New Construction, Core and Shell, Schools, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality, and Healthcare.

Category	Credit	Intent	Potential Points	LEED Intent / Requirements	FGS/PermaShine LEED Contribution
Integrated Process IP	IP Credit 1	Integrative Process	1 Point	Mandatory for all healthcare projects, all the disciplines must meet about the Project Owner's Requirements and LEED v4 credits to be attempted. A schematic design must include synergies between two of the building's systems.	A project team can enhance building system synergies with polished concrete due to the enhanced light reflectance produced by the process, resulting in energy savings, a reduced need for lighting, and assistance with daylighting strategies. For LCA requirements, concrete buildings have well documented, long-term reduced environmental impacts, due to their assemblies lasting for the building's lifespan.
Energy & Atmosphere EA	EA Credit 1	Optimize Energy Performance	1-20 Points	Design a heating and cooling system, building envelope, and lighting system that will outperform the baseline energy performance for the building, as it was calculated during the process of complying with LEED EA Prerequisite 2, Minimum Energy Performance.	Polished concrete floors provide thermal mass for a reduction in heating and cooling loads. The high gloss finish and optional concrete colorings can create a reflective surface for a reduction in lighting and ongoing energy needs. Maintenance of an FGS/PermaShine polished concrete floor requires neither waxing machines nor other energy-intensive equipment for further conservation of resources.
Materials & Resources MR	MR Credit 1	Building Life Cycle Impact Reduction	1-6 Points	Reuse a significant portion of an existing building and source local materials, products with recycled content, and those with LCA and transparency documentation.	Due to its restorative nature, concrete polishing provides reuse potential for an existing foundational slab on historic abandoned or blighted buildings. During a whole building LCA, the reuse of an existing concrete slab would lower the overall environmental impact of the project. Salvaged polished concrete can also be reused for interior surfaces such as counters, benches or window sills.
	MR Credit 2	Environmental Product Declaration (EPD)	1 Point	**Multi-Attribute Optimization** **1 Point** Building Product Disclosure and Optimization – Environmental Product Declarations (EPD): Source products and materials that have undergone an LCA and they have been determined to have environmentally, economically and socially preferable life-cycle impacts. **OPTION 1 (1 Point):** Select 20 permanently installed products from at least 5 manufacturers with EPDs prepared to ISO 14044 standards with at least a cradle-to-gate LCA. **OPTION 2 (1 Point):** Source products with single sustainable product attributes for 50% by cost of the total value of all the permanently installed products in the project. Product attributes must be verifiable with third-party certifications approved by the USGBC. Regional materials are considered those extracted, manufactured and installed within a 100 mile radius. The structural and/or building envelope cannot constitute more than 30% of the value of the compliant building products.	With concrete comprising most of the FGS/PermaShine's polished concrete floor system, this flooring option provides a reduction in a building's long term environmental impacts. The system's concrete slab can contain fly ash to replace up to 30% of the Portland cement. Adding fly ash (a recycled material) to concrete helps earn points in this category. Concrete is typically regionally sourced. Polished concrete can be installed as a low-emitting interior flooring system.
	MR Credit 3	Building Product Disclosure and Optimization – Sourcing of Raw Materials	1-2 Points	**OPTION 1 (1 Point):** The project team must install a minimum of 20 products from at least five different manufacturers that have public documentation indentifying their raw material suppliers that include, extraction locations, ecologically responsible land use, and commitment to voluntary applicable standards. Source from an extraction supplier with a Corporate Sustainability Report or similar USGBC acceptable CSR framework. **OPTION 2 (1 Point):** Use products meeting responsible extraction criteria for at least 25% by cost of the total value of permanently installed products. Extraction criteria includes: Extended producer responsibility, bio-based materials, Forest Stewardship Council wood products, materials reuse, recycled content or USGBC approved program. Credit for products sourced within 100 miles are valued at 200% of their base contributing cost.	Several product attributes of FGS/PermaShine can assist in meeting the criteria including recycled content (fly ash), material reuse, and regional sourcing. Manufacturing plants for FGS/PermaShine System located in Omaha, NE; Portland, OR; and Pottstown, PA (near Philadelphia) may be within 100 miles of your project. Please see the map on the next page for locations within 100 miles of these plants.

Category	Credit	Intent	Potential Points	LEED Intent / Requirements	FGS/PermaShine LEED Contribution
Materials & Resources (Continued)	MR Credit 4	Building Product Disclosure and Optimization – Material Ingredients	1-2 Points	Rewards project teams for selecting products with chemical ingredient inventories and product selection methods, which minimize the use and generation of harmful substances, with further rewards for using products with third-party verified life-cycle impact documentation. **OPTION 1:** Materials Ingredient Reporting (1 point): Project teams must select at least 20 different permanently installed products from at least five different manufacturers that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1 percent (1,000 ppm). To comply, the manufacturer has to publish a complete content inventory to specific guidelines, produce a Health Product Declaration (HPD), or have Cradle to Cradle assessments completed or another USGBC approved program. **Option 2:** Material Ingredient Optimization (1 Point): Use products with documents with material ingredient optimization for 25%, by cost, of the total value of permanently installed products in the project. Optimization can include the GreenScreen v1.2 Benchmark, Cradle to Cradle Certified, REACH Optimization or other international program, or another USGBC approved program. **OPTION 3:** Product Manufacturer Supply Chain Optimization (1 Point): Use building products for at least 25%, by cost, of the total value of permanently installed products in the project. Source products from manufacturers with validated safety, health and risk programs documenting the ingredients used to make the building product, and manufacturers with independent third-party verified supply chains with processes to ensure programs are in place. Products meeting OPTION 3 are valued at 100% of their cost for credit achievement calculation purposes and project teams can be rewarded at 200% if 100-mile-sourced products. Structural and enclosure products may only count toward 30% of compliant products.	The ingredients in concrete and the chemicals used to install polished concrete floor systems are primarily inert and water-based concrete coloring systems can reduce exposure to hazardous ingredients during installation of an FGS/PermaShine Concrete Floor System. Occupant exposure to hazardous ingredients in building products is also reduced for the life span of the building and during maintenance of a polished concrete floor. Disclosure of FGS/PermaShine products non-proprietary ingredients are listed on the Pharos green product database, an approved USGBC program for reporting of product ingredients.
Indoor Environmental Quality	EQ Credit 2	Low-Emitting Materials	1-3 Points	Reduce human exposure to volatile organic compounds (VOCs) while providing project teams with appropriate test methods to determine the levels of VOCs. Different materials must meet different requirement in order to comply with this credit. In all, there are six categories to be assessed, including flooring, and paints and coatings.	Polished Concrete is an interior product applied during the grinding and polishing of a concrete slab and the materials used and the process both meet the VOC minimum standards of emissions and content requirements within the flooring category. VividDye meets the VOC minimum requirements for paints and coating applied to the interior. The chemical ingredients for a polished concrete floor are compliant with the California Department of Public Health (CDPH) Standard Method V1.1-2010, Section 8. If the polished concrete floor is tinted, those chemicals also must be CDPH-compliant. Vivid Dye also meets the South Coast Air Quality Management District (SCAQMD) Rule #1113, Architectural Coatings (January, 2004).
	EQ Credit 5	Thermal Comfort – Design	1 Point	Design the HVAC and building envelope to ASHRAE Standard 55-2010 or relevant international (ISO) or Canadian (CEN) standard. Project teams just provide occupants a means to adjust temperature in at least half of all shared spaces, except hotels and every patient must have access to thermal comfort controls. Thermal comfort controls must provide occupants the ability to adjust air temperature, radiant temperature, air speed of fans and/or humidity levels.	Polished concrete floor systems can complement the installation of a radiant flooring system and the thermal mass of a polished concrete floor is conducive to passive heating and cooling strategies.

Continued on Page 34

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

fgsPermaShine polished concrete

Category	Credit	Intent	Potential Points	LEED Intent / Requirements	FGS/PermaShine LEED Contribution
Innovation in Design*	ID Credits 1-4	NC & CS: 1-5 Points; Schools	1-4 Points	ID Credits reward project teams for exceptional performance above the requirements set by the LEED v.3.0 for New Green Building Design and Construction rating systems 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. The LEED v.2.2 Innovation in Design Credit Catalog was last updated in March 2008, and there is no guarantee any of the ID Credits accepted by the Council will be accepted under the new LEED v.4.0.	Concrete construction in general and Polished Concrete Floor Systems specifically can improve a LEED v4 project team's potential for additional points in the LEED ID Credit Category. The thermal mass properties of an FGS/PermaShine Polished Concrete Floor System provide project teams opportunities for exemplary energy conservation and net-zero energy design and construction. Passive heating and cooling strategies can assist in energy conservation far beyond the requirements in LEED EA Credit 1: Optimized Energy Performance. Polished concrete floors also provide projects with potential single sustainable product attributes beyond the requirements of the respective Materials and Resources (MR) Credits especially for its recycled content and regionally sourced materials. The same is true for zero-VOC concrete coloring products such as L&M's Vivid Dye, which can provide exemplary performance in the respective Indoor Environmental Quality (EQ) credits.
	ID Credits 1	SCAQMD Rule #1113 Verification	1 Point	An architect must sign a letter to the effects that the FGS/PermaShine Hardener Plus product meets SCAQMD Rule # 1113. The densifier contains Zero-VOCs and concrete coloring products such as the FGS VividDyes come in a Low-VOC formula. The FGS Concrete Conditioner for periodic maintenance of a polished concrete floor also contains Zero-VOCs. Additional submittals include: a copy of the SCAQMD VOC limits, verification that the use of the products is not a code requirement and not industry-standard practice, calculations showing that these interior coatings were applied to a significant percent of the interior surfaces, list of all interior coatings showing their VOC performance levels and the percent of surfaces covered by these Low-VOC products.	The FGS/PermaShine system can meet or exceed the requirements and provide submittals to have an Innovation in Design credit for exceeding the current benchmark in LEED for reducing installer and occupant exposure to odorous, potentially irritating and harmful air contaminants from industrial maintenance coatings. The benchmark in rating system is the South Coast Air Quality Management District (SCAQMD), Rule # 1113.
	ID (EQ NC) Credits 2	Green Cleaning	1 Point	The project team must have an Indoor Air Quality (IAQ) Management Plan, flush out filters and replace with MERV 13 filters, and utilize a green cleaning service using green procedures that comply with GS-37 or the California Code of Regulations for maximum VOC content, and demonstrate that the products used in the project are non-hazardous, have a low environmental impact and are environmentally preferable.	The FGS/PermaShine process involves dry grinding the concrete slab, eliminating disposal of messy, wet, and heavy slurry produced by older grinding methods. Dry grinding also eliminates heavy water use, minimizes downtime and the grinds can be potentially reused. The FGS Concrete Conditioner cleans with less water use and has passed a third-party verified testing to the minimum CDHS VOC emissions standards for use in LEED and CHPS school buildings.
	ID (MR NC) Credit 3	Materials Minimization/ Recyclability	1 Point	The project team must implement strategies to limit the amount of construction materials used, and install materials easily deconstructed for reuse or recycling once the building has reached its useful life span. Reduce a building's square footage and decrease conditioned space; leave structural systems such as a concrete foundation slab exposed to eliminate floor coverings; and select recyclable materials and leave joints exposed to enable future deconstruction, reuse and recycling.	The FGS/PermaShine system is installed on a foundation slab and therefore can reduce environmental impacts associated with flooring materials used to cover bare concrete floors, as well as associated environmental impacts of manufacturing and transportation of vinyl tiles or carpeting to a building site due to the various potential architectural uses of the foundation slab with the FGS/PermaShine system.
	ID (EQ NC) Credit 4	Post-Occupancy Survey	1 Point	Building teams committed to evaluation of the comfort of the building occupants after they arrive can gain a point here if they follow the previously accepted requirements of the Council. The post-occupancy survey must measure the environmental variable based on those in ASHRAE Standard 55-2004 and develop a corrective plan if more than 20% of occupants are not satisfied with the heating and cooling, lighting and security conditions of the building after 18 months in the facility.	The thermal mass of FGS/PermaShine levels heating and cooling loads offering high energy efficiency and the potential for high thermal comfort of the building occupants for the life of the building.

*Reference: U.S. Green Building Council, Innovation in Design Credit Catalog, March 2008 Update, for LEED v.2.2 for New Construction and Major Renovations.

Relevant Regional Environmental Priority LEED Credits:

Regional Environmental Priority LEED Credits were introduced in LEED 2009 for project teams to address geographically specific environmental priorities. This new concept does not create additional LEED Credits, but assigns more weight to existing Credit(s) that address regional issues. The LEED project administrator enters the zip code of the building site and can choose to address up to four of the region's environmental priorities for a potential of four LEED points. There are lists of Regional Priority LEED Credits for the 50 U.S. states, District of Columbia and Puerto Rico. FGS/PermaShine improves energy and environmental performance and therefore can potentially help project teams add points for addressing Regional Priority LEED Credits.

**Visit www.usgbc.org/LEED2009 for full details.*

Notes:

fgsPermaShine
polished concrete

Available exclusively from

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