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Reprint**



L&M
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NOVELTIES

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the results are in:
One Tough Floor

FGS®
PermaShine®
The new face of polished concrete

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How could a floor that looks this good be **SO TOUGH**



Fitness Center
Arkansas

It is very seldom that a concrete floor fails structurally, but they all suffer from the abuse of abrasion. In other words, all concrete floors, over time, will wear out.

Until the present time, these old, worn out concrete floors would have to be replaced, or at least have a topping applied to the surface. Repair and replacement processes are not only costly, but also require a lot of facility down time. A renovated or replaced concrete floor could be out of service for days or weeks.

Today, it's different. A worn concrete floor can be quickly resurfaced and returned to service in hours, not days or weeks. This new rejuvenation process is the diamond polishing of concrete floors, or, as we at L&M call it, FGS PermaShine Polished Concrete Floor System.

FGS PermaShine is a patented process by which a concrete floor is ground flat, diamond polished and then chemically hardened. It employs a dry grinding process that carries less environmental impact than older, terrazzo grinding systems that generate a hazardous wet slurry mixture of spent concrete dust and dirt. We can do this through the use of specialized, high performance grinding equipment and very efficient vacuum systems, which trap microscopic airborne dust particles and leave the air 98% dust-free.

In fact, under real world conditions FGS certified installers have diamond polished concrete floors in retail store areas without having to take the stock off the shelves. Within an hour after our FGS Hardener Plus (chemical hardener and final step) has been applied, the floor can be returned to service. There are no odors and little facility down-time.

To insure the highest quality finished surface, the patented FGS PermaShine polished concrete floor system is installed (1) only with certified, approved installers, (2) using only FGS approved grinding and polishing equipment, and (3) only FGS approved chemical treatments which strengthen the concrete and provide a long term low-maintenance surface.

An important fact about FGS PermaShine is that this is a very green process for which LEED credits may be earned. FGS PermaShine floors contribute to LEED points in a number of categories (see related article this issue; the process:

- uses VOC free chemical treatments, (no solvents), for improved air quality of the finished building and a healthier work environment;
- recycles concrete floors, Building Reuse;
- does not create a hazardous waste (the wet slurry of other processes);
- encourages the use of bare concrete surfaces so that the owner can more fully benefit from the inherent reflective and thermal mass properties which optimize energy performance;
- provides exceptional durability and very low on-going maintenance costs.

It is often thought that a floor that has a high shine must be a slip-and-fall



hazard. This is not true with FGS PermaShine polished concrete. We have had a number of our FGS PermaShine floors tested by the National Floor Safety Institute (NFSI) and certified as High Traction, complying with ADA and OSHA requirements for both wet and dry conditions. FGS PermaShine treatment and maintenance retains the natural non-slip properties of concrete.

Another misconception held by some is that a polished concrete floor is automatically hard and dense. This is not true. Actually, the mechanical grinding and polishing of concrete does not harden it, it weakens it. Only the proper chemical treatments can restore the concrete to its original strength, and then improve upon it. Let me explain.

Most concrete floors, when originally placed, are physically hardened during the placement process by an activity known as "hard troweling." Hard troweling is a process by which the very small, unhardened particles of cement are physically compressed and forced close together to provide a smooth and durable floor surface. As the concrete sets up and then cures, and when the cement hydration takes place, a very rich field of calcium silicate hydrate (C-S-H) is formed. This process produces a surface that is very much harder and denser than the underlying concrete. We call it the "near surface wear zone" which is roughly the top 1/8 inch (1-2 mm) of the concrete floor.

Now, depending upon the original condition of the floor, the grinding and diamond polishing process removes some or most of this hard troweled surface and leaves a surface that is comparatively porous and soft. So, while the concrete may be polished to a high shine, the surface is not hardened. Without the use of our FGS Hardener Plus, the attractive finish of a polished concrete floor will be quickly worn away. *It is the chemical hardener that protects the shine and prevents the shine from being worn away.* And none do it better than our FGS Hardener Plus.

How can the surface of a concrete floor, one which may be many years old, be hardened?
The answer lies in the chemical makeup of the portland cement paste and the FGS Hardener Plus.

It is a known fact that 15% to 20% of the hardened cement paste is calcium hydroxide. Calcium hydroxide is a comparatively soft material that does not contribute to the hardness or strength of concrete. The reaction between the FGS Hardener Plus and the calcium hydroxide produces C-S-H (calcium silicate hydrate). As stated above, this is a similar reaction to what happens when portland cement hydrates: C-S-H is formed.

Therefore, it is the powerful chemical reaction of our chemical hardener which enriches the surface of the treated concrete by transforming soft calcium hydroxide into strong calcium silicate hydrate materials, and in the process the surface of the concrete is hardened and densified. This important treatment protects the shine and makes the cost of polishing concrete an economically viable option for building owners.

To prove our point, L&M engaged Construction Technology Laboratories (CTL) in Skokie, Illinois to carry out a series of definitive tests to determine the actual physical benefits of our unique process to a treated concrete floor and to substantiate our assumptions and claims. The object of this series of tests was to compare the durability of an FGS PermaShine polished concrete floor to that of a well cured concrete floor with a hard troweled surface.

The term "well cured" is a key factor. Others have chosen to compare their product and process to distressed concrete with an abnormally soft and extremely dusting surface which, of course, makes their products to appear more effective. In contrast, our testing is carried out with high quality laboratory specimens to provide a more reliable reading of the outstanding benefits of the FGS PermaShine process.

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The test that proved the important difference:

CTL was instructed to cast nine concrete slabs, one foot square and three inches thick, from a single batch of concrete. Each sample was given a hard troweled surface and then moist cured for seven days. At the end of seven days, the samples were removed from the moist curing room and allowed to air cure at laboratory temperature.

Three of the samples were retained as untreated control samples with a hard troweled surface. When the six remaining samples were 28 days old, and had reached a design strength of over 4,000 psi, they were diamond polished using 5 steps with a final step at 1500 grit. This is a normal high gloss finish level used in many retail and commercial projects.

Three of the six diamond polished samples had a single, saturating coat of FGS Hardener Plus applied at the rate of 250 sq ft/gal. The three remaining diamond polished samples had two saturating coats of FGS Hardener Plus applied as per our standard recommendations: the first coat saturating the surface at the rate of 250 sq ft/gal, and the next day a second application of FGS Hardener Plus at the rate of 350 sq ft/gal.



Inside the Testing

Concrete specimens were stored in curing room 90 days before testing began.



ASTM C 779 abrasion testing device.



Close up view of abrasive discs of the ASTM C 779 testing device.



Concrete specimen after abrasion testing.



Micrometer bridge and micrometer used to measure the depth of wear, averaging 96 distinct readings.



Rilem Tube being filled with water for absorption testing.



Rilem Tube filled with water. (close up view)



All nine samples—three control and six treated—were then returned to the temperature- and humidity-controlled curing room and allowed to air cure for a total of 90 days before testing commenced. At the end of the 90 days of curing all samples had abrasion testing preformed in accordance with ASTM C 779 Procedure A and Rilem absorption testing Method No. 114.

Test Results

Table 1: Testing results for Abrasion Resistance ASTM C 779	Wear In Inches	
	30 Minutes	60 Minutes
Control Hard Troweled	0.021 Inches	0.041 Inches
One Application FGS Hardener Plus	0.016 Inches	0.033 Inches
Two Applications FGS Hardener Plus	0.008 Inches	0.021 Inches

Table 2: Testing Results for Rilem Tube Absorption	Cumulative Absorption (ml)	
	1 Hour	24 Hours
Control Hard Troweled	0.8	3.9
One Application FGS Hardener Plus	0.5	2.8
Two Applications FGS Hardener Plus	0.2	1.1

As can be seen in **tables 1 and 2**, abrasion resistance and absorption characteristics of treated concrete using the FGS PermaShine system have been greatly improved over that of **well cured, hard troweled** concrete. It should be pointed out that the second application of FGS Hardener Plus doubles the abrasion resistance and reduces the absorption by more than half that of a single application of FGS Hardener Plus. Also, note that all chemical treatments are applied at the end of the grinding and polishing process. In that manner, all the final benefits transfer completely to the owner and are *not* used simply to facilitate the polishing process by an installing contractor, a technique many other companies employ.

As stated earlier, the grinding and polishing process opens the concrete surface. The first application of FGS Hardener Plus increases the density of the surface. When the second application is applied, FGS Hardener Plus reacts almost completely within the near surface wear zone (the top 1/8 inch of surface) producing a very rich field of calcium silicate hydrate. As can be seen in table 1 and 2, the FGS PermaShine system produces a concrete surface that is far more abrasion-resistant and far less absorptive than that the original concrete surface. This results in an attractive, extremely durable floor that will outlast other competitive processes.

In conclusion, as the benefits of a polished concrete floor are becoming more and more popular, it is important to know that not all systems and processes are equal. It is the combination of a patented, dry polishing system, installed by certified installers who use FGS approved equipment and the superior chemical treatments of the FGS PermaShine System that produces both an attractive floor and a long term, economical solution for building owners.

To learn more about FGS PermaShine, please contact us directly at 800-362-3331 or visit www.fgs-permashine.com.