The IPCI Journal
QUARTER 3, 2008

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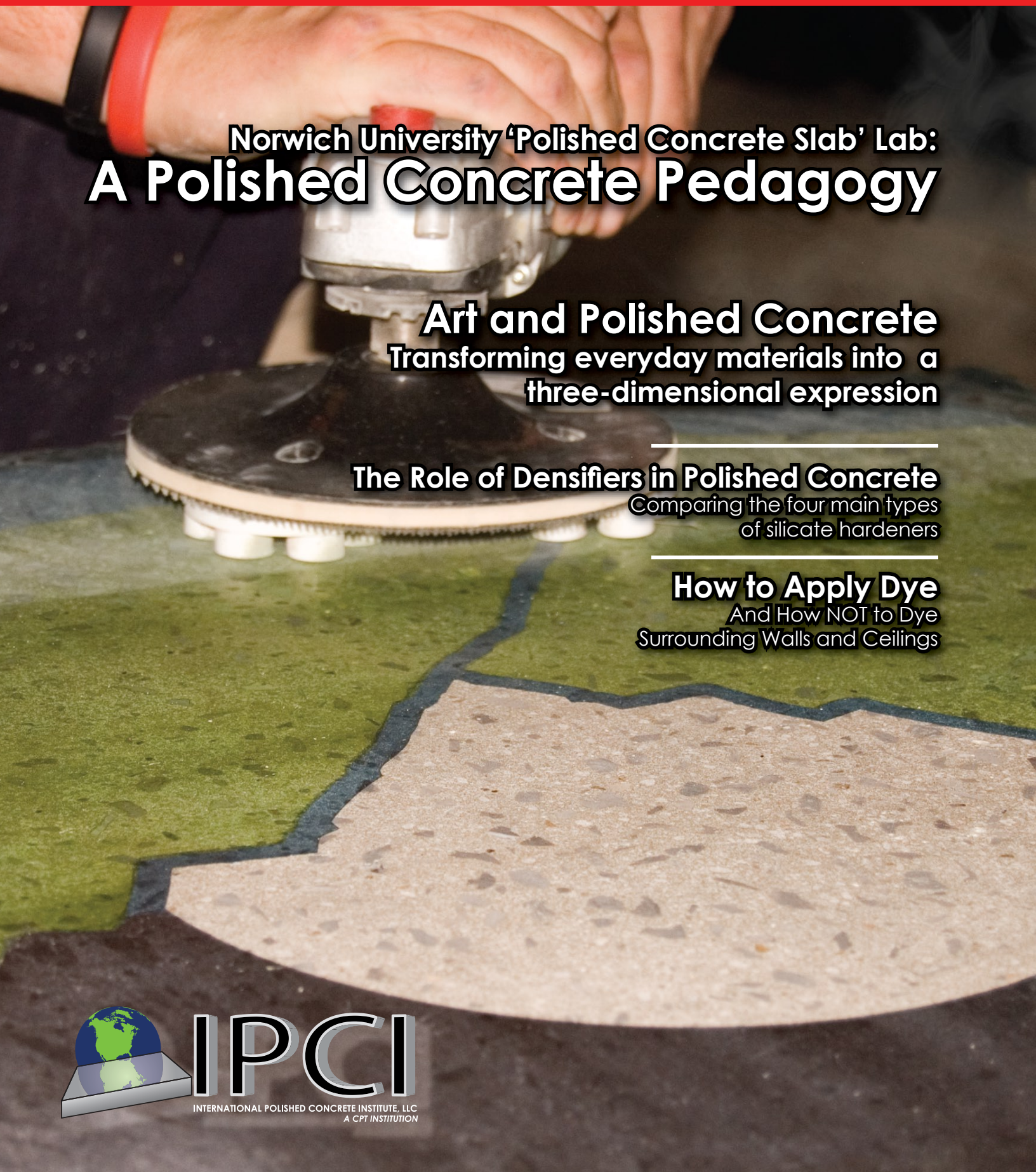

Norwich University 'Polished Concrete Slab' Lab:
A Polished Concrete Pedagogy

Art and Polished Concrete
Transforming everyday materials into a three-dimensional expression

The Role of Densifiers in Polished Concrete
Comparing the four main types of silicate hardeners

How to Apply Dye
And How NOT to Dye Surrounding Walls and Ceilings

IPCI
INTERNATIONAL POLISHED CONCRETE INSTITUTE, LLC
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The IPCI *Journal*

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News from IPCI

2008 Member Surveys are on their way. We want to know what resources you need and how IPCI can better serve you.

Polisher News: Our Pour to Shine Polisher Continuing Education Course was a great success! For all of you who missed it, the handouts from this course, AND our April Sales and Marketing Course will soon be available to download in "Polisher Aids" under the Resources tab.

Architect News: Additional specification information is being developed, as well as edits to the existing Build-A-Spec documents.

Have a project you need a polisher for? POST IT! **IPCIonline.com**

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HOLLY DUMONT graduated from Lawrence Technological University in 1991 with a Bachelor of Science degree in Architecture. She now works for the Daimler Chrysler AAME Building Group and has been using polished concrete in her projects for years. Holly has been an AIA member since 1996.

DAN FARMER currently works with Michael Brady, Inc., in downtown Knoxville. After graduating from the University of Tennessee in 1982 with a bachelors degree in Architecture, Mr. Farmer has continued specializing in spec writing. In addition to being a member of AIA, he is a member of CSI, and holds a Construction Specifier Certification.

MATTHEW LUTZ is Assistant Professor, School of Architecture and Art at Norwich University in Northfield, Vermont. After receiving his Bachelor of Fine Arts at the Historic Preservation, Savannah College of Art and Design, he went on to receive his Master of Architecture, Virginia Polytechnic Institute and State University.

SCOTT HATMAKER graduated from the University of Tennessee College of Architecture and Design in 2001 and is currently working as an intern architect for 3g Studios Architecture and Planning in Knoxville, TN.

JUAN PORAL, of Grimshaw, received his Master of Architecture degree from University College London, after receiving his bachelors with honors from the University of Nottingham. Mr. Poral joined Grimshaw in 1996, initially working on the competition winning proposal for Fundacion Caixa Galicia Arts and Cultural Center, in A Coruña, Spain. Juan moved to Grimshaw's US office in 2001, working as Project Architect on the Miami Intermodal Center project in Miami, Florida.

PAVEL GETOV received a Master of Architecture degree from the Southern California Institute of Architecture (SCI-Arc) in 1993, and a Diploma of Architect from the Higher Institute of Architecture and Civil Engineering, Sofia, Bulgaria in 1988. He has worked with Richard Meier and Partners, NBBJ and currently with Morphosis on numerous nationally and internationally recognized projects.

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The Role of Densifiers in Polished Concrete

Comparing the Four Types of Silicate Hardeners

By Dan Farmer, Featured Designers Corner

The concrete polishing process consists of mechanically abrading the surface of the concrete with grinders to remove material from the surface, smoothing and flattening the surface and in many cases exposing the larger aggregate to form a decorative surface. This process can remove as little as 1/32 inch to as much as ¼ inch or more of the surface material of the concrete. Integral to this process is the application of chemical agents to harden and close the surface pores, sealing it against the penetration of moisture. The contaminants borne by this moisture cause discoloration, staining, and in some cases, deterioration of the concrete itself. The chemical application fills the pores, increasing the density of the surface and making a smoother, flatter surface, which allows light to be reflected evenly rather than being diffused by empty pores. It also increases the surface abrasion resistance by 25 percent or more. This finished polished concrete surface is the result of the reflective characteristics of the concrete itself and not a surface film or membrane, thus it does not peel, rubber tire burn or require recoating.

Silicate hardeners (also called densifiers) are water based chemical solutions that react with the calcium hydroxide in the concrete to produce calcium silicate hydrate (CSH); the same material that is produced in the reaction between Portland cement and water, giving the concrete much of its strength. Four basic materials are used as the active ingredients in these products: sodium, potassium, lithium and magnesium. Manufacturers add wetting agents and other substances to their silicate products to improve penetration and enhance the chemical bond. Each product type has its proponents and many argue long and loud about the merits of one over the other, though they all work in the same basic way.

Sodium silicate is the most common and the least expensive. Potassium silicate

Continued on page 10

Art and Polished Concrete?

Transforming Everyday Materials into a Three-Dimensional Expression

By Sharon Harry, Featured Cutting Edge

Sculpture can transform an ordinary material into a three-dimensional expression that must be physically experienced to have meaning. This is student artist Valeria Yamamoto's belief, and her sculpture was created to be as interactive as possible.

"I just wanted people to want to touch it," claims the Florida International University Art Graduate, speaking of the polished concrete used to create "Seawhisper", the seven foot tall sculpture resembling a large conch shell that was first revealed at FIU's BFA exhibit at the Patricia & Phillip Frost Art Museum. The polished concrete finish lends the sculpture a light wet look; an esthetic that is synonymous with maritime. With the ocean as the core inspiration for "Seawhisper", the organic shapes serve as a reminder of the beach, with the intention of producing a calming effect, even in all the hustle and bustle of urban life.

At first, Yamamoto was concerned that the placement of "Seawhisper", in an outdoor corridor, would be remote; that too few people would get to see the sculpture. However, the massive size, fluid shape and unique finish of the piece drew onlookers to it with interest. "People in the space are part of the sculpture," Yamamoto explained. Yamamoto dedicated a good deal of time working to finish the interior curvature of the 'shell', even experimenting with the form in an attempt to recreate the acoustic resonance of the waves (that shells on the beach are said have when they are touched by the wind). "The opening was not right, but you do get a shooshing echo from listening to it!"

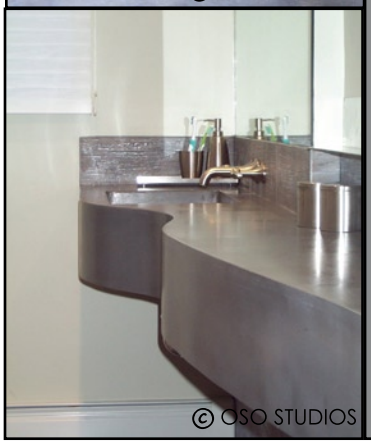
"Many other materials were not suited to her needs," remarks Dr. R. F. Buckley, Sculpture Professor and Head of Sculpture Department at FIU and mentor to Yamamoto. Dr. Buckley declared that even though plaster is a very popular choice among students for

this type of work, its very soft nature could not withstand the elements once placed in an outdoor corridor. Buckley goes on to state that the right material would be a product that could be built up, similar to a plaster, and would, "…meet the rigors of the structure and [of the] elements." Polished concrete was the obvious choice; the concrete being durable enough to display outdoors, the polish making it visually inviting and impossible not to touch.

Creating a sculpture demands a great deal of physical effort be given by the creator to ensure success. "I wasn't sure how it would work," Yamamoto reveals. "With a painting, you have a feeling. With a sculpture, you have gravity. Gravity doesn't always cooperate." As those in the concrete industry know, concrete can be a challenge to work with, and temperamental based on many factors; such as the surrounding weather. Not a problem for a painter, but a huge problem when sculpting and polishing. "There were many problems to solve during the process. With a painting, humidity doesn't affect it. You don't have to worry about your piece breaking." Through dedication and hard work, Yamamoto met the physical challenges of molding the concrete head on and defeated the problems that presented themselves during the formation and polishing process.

Yamamoto stated that she would like to work with polished concrete again. Mentioning the unique qualities of concrete, "I most like the texture. [I like the] irregularities in the concrete. It is natural, not plastic, and has the quality of stone. It is cold but it changes color when it is wet." Dr. Buckley has little doubt about Yamamotos future success as a working artist, and describes her as a 'dynamo'. "Take a group of people and Valeria makes teaching worth while. She makes good art, and works at it everyday."⬣

"Seawhisper" is on display at the Third Biennial Sculpture Exhibition in Chattanooga, TN, from August 2008 – February 2010.



Art in the Mainstream

Sculpture is not limited to the museum or the art world. OSO industries uses concrete everyday in unexpected ways.

Eric Weil, owner of Oso Industries, graduated from Oberlin College where he studied sculpture. After furthering his education in Ghana, where he was inspired by traditional furniture design, he moved to New York City and worked in a series of manufacturing jobs that used sculpting and mold-making processes. Through these experiences, Eric learned to work with castable materials like concrete, and began experimenting with techniques for coloring it and shaping it into new curvaceous forms. Today Oso Industries bridges the gap between art and the design community by blurring the lines between sculpture and furniture.

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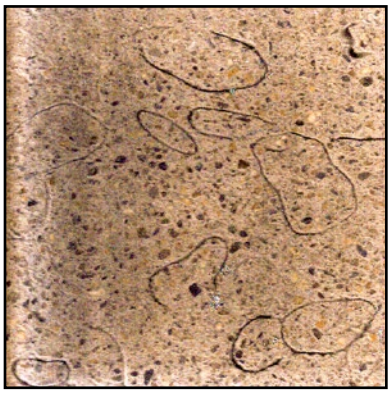
A Polished Concrete Pedagogy

Polished Concrete Slab Project Broadens Minds

By Rebecca Miller, Featured Case Study

Assistant Professor Matthew Lutz of the Norwich University School of Architecture and Art is supporting the college's lofty state mission of teaching students ***"The meaning of making and the making of meaning"*** through an original, polished concrete lab assignment in the sophomore-level Materials, Construction and Design class he teaches. "At Norwich we believe architects are makers of things that point to a larger meaning…and as an accredited architecture school, we use a combined curriculum approved by the NAAB (National Architectural Accrediting Board) which calls for materials studies as part of the program," Lutz explains. To this end the Assistant Professor created the Polished Slab Project, an individual, semester-long task designed to teach students to search for the extraordinary in seemingly everyday building materials - like concrete. Lutz's hands-on lab incited the kind of enthusiasm rarely found in a lecture hall. "The class was excited, really excited about the possibilities," he says. "My charge to them was to add something unique to the mixture…anything from changing the admixture to including glass beads, coloring, or recycled materials…the result was that 'ahh-factor' that is irreplaceable in the learning process."

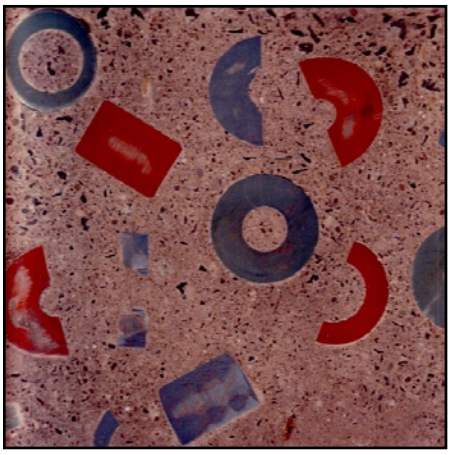


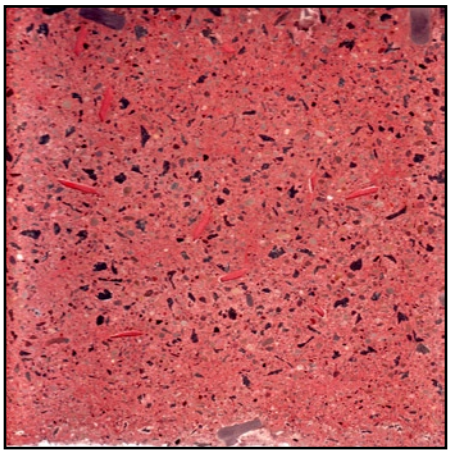
"Before the Slab Project, the students generally believed cement and concrete were interchangeable terms and materials," says Lutz. By the end of the class, the project had not only taught them the difference, but had opened these future architects eyes to the power and visual impact a floor can have on the interior of a building. Much like the majority of the public, Matt's students had never seen, or at least had never noticed, polished concrete as a flooring application. "Most people do not think of concrete as an indoor option." he comments, "…they learned first hand that concrete isn't just for garages." Lutz concludes, "Drawing the students' attention to detail was the best lesson that came out of this project."

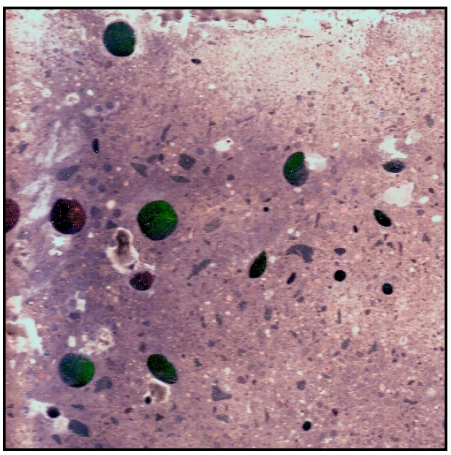
Peter Abiles, a student who took the course, concurs, "I used to think of concrete as only the stuff of foundations...This project changed my mind. It's one thing to learn about materials in a classroom via slideshow and entirely another to learn hands-on. It gave me a better perspective on possible uses." Abiles forecasts that his future projects will include polished concrete. "It's a cool thing," Peter relates," and I like the look of it."

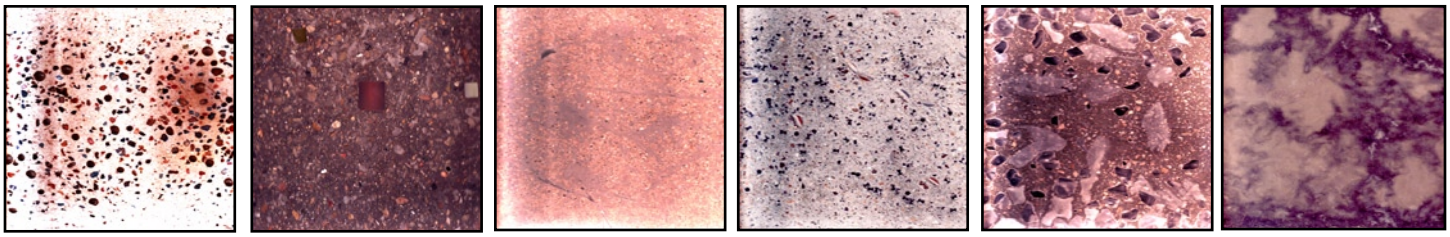
The guidelines and due dates of the Slab Project were looser than a standard MLA-formatted term paper; Matt was more concerned with individual creativity than a notebook full of instructions. "I didn't want the students asking 'what does the faculty want to see out of this'… I wanted them to think about their project and what it could be." He did, however, give clear instructions to the class: the slab was to be 10 x 17 with a 2.5 inch thickness, and the students were responsible for building the formwork, making a unique admixture, curing, and polishing the concrete to a 3,000 level [resin] grit. "…almost anything the students could come up with was OK, as long as the general requirements were met."

Lutz kicked off the assignment by showing the students close-up photos of concrete samples. "It's

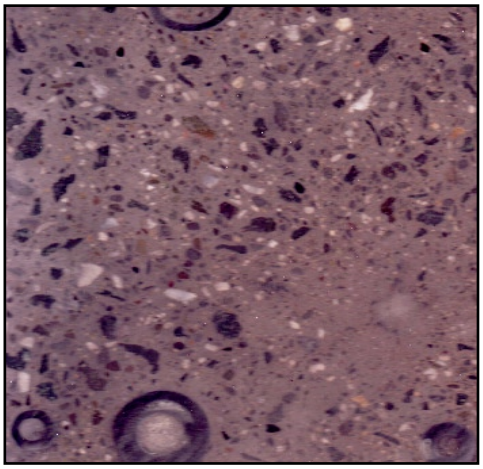








important to show good examples up front," he advises, "because you have to set the standard… one picture even showed a glowing blue slab, which really got their attention and made them think about what concrete could be." The examples Matt showed were, he said, "to set up an almost unrealistically high level of expectation…to set up a goal."



"It was amazing how different each slab was…despite the same set of instructions every student ended up with a unique piece," says Lutz. In total there were 40 slabs presented in class.

Peter Abiles interesting concept was to create a "giant concrete magnet" by adding iron filings to the mixture. He reasoned people could use magnets to hang things on the concrete instead of drilling into it. "Once it was dried and polished it ended up looking like metal and the magnets stuck," Abiles says. "One girl used India ink, which turned out looking like marble…it was beautiful," says Peter, "and a guy included copper tubing, which turned out really shiny." Another enterprising green-minded student added ground-up tire fragments, thinking flooring could be a great place to recycle such refuse. Still others added topical dye treatments or glass components for an artsy finish. Peter says his classmates did a lot of cool, unexpected things with the slabs, and added that "it was really fun despite the hard work involved".

Assistant Professor Lutz "definitely recommends the Polished Slab Project to other teachers in the field," adding the advice to "think ahead of time about a way to display the slabs…at Norwich we are creating a permanent exhibit." He says this gives the students extra incentive to think creatively. University of Cincinnati School of Design, Art, Architecture and Planning student Craig Moyer, whose course curriculum does not currently include anything like the Slab Project, says he would like to do similar studio work because he would "benefit from alternative ideas and design solutions." ⬣

Curriculum Adaptation

For other schools considering adapting the Polished Slab Project, Assistant Professor Lutz gives the following advice:

- *Start early to give the students plenty of time*
- *Take grading pressure off by scoring on completion (a score of 100% for a slab made with all requirements)*
- *Make sure the first projects presented are nice examples as they will set the baseline*

He also says to emphasize the important side lesson the project teaches-- that guidelines do not have to hinder creativity.

Student Peter Abiles advises professors "not to tell the students what has been done before, let them see what they can come up with, make sure they have an area that they get messy. We covered a room in our building in concrete dust!" He concludes his thoughts saying, "Professor Lutz's project fit well with the curriculum. It was a simple project that allowed us as students to explore and understand the practicality of polished concrete."

How to Apply Penetrating Dye

And How NOT to Dye Surrounding Walls and Ceilings

By Joe Dew, Featured Tech Tip

Are you currently polishing concrete?

Want to offer your customers the 'latest and greatest' without a significant investment?

Are your artistic abilities just a hair above your daughter's kindergarten stick figure portraits - drawn with crayons?

If you said yes to one or more of these questions, let me tell you how to use a simple product that will impress your customers and make you a decent return on a small investment!

Dye.

One word. A word so powerful I gave it its own paragraph!

First, let me explain that there IS a difference between dyes and stains. Stain, is a term most commonly used when talking about 'acid staining'. Acid staining has its place in the market, but is not the preferred choice in a concrete polish job. Dye is more preferred for polished concrete since it penetrates the slab and leaves nothing on the surface. This is not an article trying to convert the stainers of the world to dyers, so let's move on.

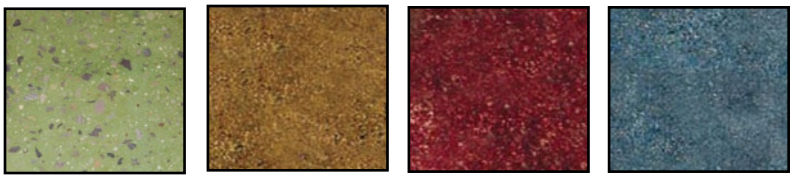
Dye is shipped out in powder form to be mixed with a base before use. The two types are solvent-based or water-based. The most popular, for now anyways, is solvent-based, and the solvent used is acetone.

So, why is dye not shipped pre-mixed? Acetone is labeled as HAZMAT with shipping carriers. Carriers like to charge a king's ransom for products such as acetone because of the liabilities involved. Save money by buying acetone at your favorite home store, or for larger quantities, a local chemical blending company. Mixing directly into the can of acetone is a really good idea for three reasons:

1. It's easy to shake so it will dissolve all colorant particles.
2. You can easily record the mix date and color on the can using a magic marker.
3. Your can of dye stays contained until needed, making it easier to transport and store.

Mix your dye 24 hours in advance. Preparing your dye ahead of time will guarantee that all particles are totally dissolved before the application process begins. Mix dye with the acetone and shake as long as you can physically endure the day before then shake again three hours prior to application. Pour your dye into an acetone resistant sprayer and proceed directly to the application process.

Have you noticed a few words used so far like 'Steel Can' or 'Acetone



Resistant Sprayer'? Ok, just one more chemistry lesson. Acetone is an emulsifier. Emulsifiers are designed to breakdown or dissolve petroleum based products, including plastic and rubber. Hence the reason acetone is stored in steel containers.

Now, I need you to grab a hold of this one. Repeat after me; "I will always, absolutely, 100% of the time, without reservation, apply acetone-based dyes using ONLY an Acetone RESISTANT Sprayer." Failure to heed this warning may cause the following issues: personally going home a different color than when you left; painting or replacing walls; replacing carpets and/or ceiling tiles. Just trust me on this one.

Generally, dye is applied after the 400 grit resin step, but depending on the final shine and the floor, you can tweak it to determine what best suits your project. Clean and prep the floor to prepare it for the colorant. Making sure the floor is as dust free and dry as possible is key during your application process.

Next, just spray the floor in a circular motion and make sure you are getting even coverage and watch for color variations that may need a second coat. Be sure to walk the floor spraying in or feathering out any shadows or lighter hues. You will notice a 'chalk like' film setting nicely on your floor. That has to come up! Wipe up excess dyes that did not penetrate into the concrete slab by using either clean water or light amounts of clear acetone. After this cleanup, proceed with your remaining polishing steps.

Presto - The floor looks good! Let's keep it that way.
Sealing the floor must be done to protect the customer's investment. I suggest a high solid, semi-penetrating sealer. Sealers should be applied using a micro-fiber applicator in thin coats. Multiple coats may be used, but check with your vendor first. Applied properly, this product will maintain a high sheen for up to a year, depending upon traffic, while locking in the dye.

And you've done it! You've made your customer happy by offering them a floor that is completely unique with that one powerful word: Dye.⬣

IPCI Project Highlight
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Challenges Overcome

- ***The Challenge:*** *Overcome poor flatwork, bad weather, and other trades to install a beautiful floor*
- ***Scope of Work:*** *Coating Removal: Topical Sealer Grind and polish plus dye*
- ***Sq./Ft.:*** *5,800*
- ***Agg:*** *Inconsistent Exposure*
- ***Sheen Level:*** *Glossy Shine*

This project allowed Professional Concepts to flex their polished concrete muscles. Every slab is different, and as experienced polishers know, you are likely to run across one or two common challenges on each one: poor communication, bad concrete, etc. This project had them all, from bad FFs and unconsolidated aggregate, to the weather itself causing issues with humidity. Through quick troubleshooting, strong communication, and a bit of technical support, this project turned out to be a success! Starting at 16 grit diamonds, the team ground through to expose a beautiful finish. Their second mobilization found hydraulic oils from other trades penetrating the floor. After removing the stains, Professional Concepts completed a glossy shine and left with one satisfied customer.

The Role of Densifiers in Polished Concrete

Continued from page 3

is probably next in terms of popularity. Lithium silicates are gaining popularity because they may offset the effects of reactive aggregates which may be present in concrete. Magnesium floro-silicates can react with both calcium hydroxide and calcium carbonate to form insoluble by-products within the pores of the concrete.[1]

When the hydration reaction occurs in curing concrete, silicate compounds within the cement react with water to produce calcium silicate hydrate (CSH). It is CSH that bonds with the small and large aggregate to form concrete. An important consideration in this reaction is that significant amounts of calcium hydroxide are left over from the reaction and the resulting concrete is very alkaline (12- 13 on a scale of 1 – 14). Calcium hydroxide is very high in pH, is soluble in water, and has very little ability to bond aggregates together. At the 28 - day cure point, 15 to 20 percent of the hydrated Portland cement paste is calcium hydroxide. Thus, there is a large amount of calcium hydroxide that can be converted to CSH, strengthening the concrete. All that is needed to make this happen is a source of silica.

Two things occur when a liquid silicate solution is applied to cured concrete. First the liquid silicate solution reacts with the available calcium hydroxide and forms CSH, strengthening the concrete. Also, by converting some of the calcium hydroxide into CSH, the pH is reduced[2]. Liquid hardeners should not be placed on freshly poured concrete in order to maximize their effectiveness. During the first days after placement, the pores of the concrete are saturated with water not absorbed by the hydration reaction. This free water aids the ongoing hydration process but also causes the pore structure to be swollen, reducing the size of the capillary pores. This significantly reduces the ability of the applied liquid hardener to penetrate into the near surface regions of the concrete. By the end of seven days, free water in the pores is greatly reduced, making the pore structure more open and allowing greater penetration of applied liquids into the concrete. Additionally, the longer the hydration reaction has been ongoing, the more calcium hydroxide will be available to react with the

silica. Under normal conditions, most concrete will achieve about 60 – 65 percent of its hydration within seven days and produce a proportional amount of calcium hydroxide.

As soon as the hardener is applied to the surface of the concrete, the silicate immediately begins reacting with the calcium hydroxide present in the concrete, densifying the concrete but also filling the pores of the concrete, limiting the penetration of the hardener. The total penetration of the hardener into the concrete is limited to approximately 1/8 inch. With this in mind, the application of hardener is best coordinated with and accomplished during the polishing process. These hardeners should be applied by saturating the surface with hardener and working it into the pores of the concrete using power driven scrubbers. This forces the reactive ingredients into the pores of the cement paste and removes impurities from the near surface allowing more contact between the chemical hardener and the calcium hydroxide compounds, increasing the effectiveness of the hardner.[3] The surface should then be flooded with water to remove residual materials and chemicals to avoid discoloration of the surface. Additionally, silicates left on the surface react with carbon dioxide in the atmosphere to form a white residue (carbonation) which is difficult to remove. As mentioned earlier, grinding and polishing remove the material at the surface of the concrete, often removing 1/8 inch or more. Thus the application of liquid hardeners should be scheduled between the preliminary grinding and the final polishing steps of the polished concrete process.

1. *"Using Liquid Hardeners to Enhance the Diamond Polishing Process" Joe Nasvik, Concrete Construction 9/1/2004.*
2. *"Its Chemistry, Not Magic; Debunking more Myths and Misconceptions About Chemical Hardeners" Phillip Smith: L&M Construction Chemicals, Inc. News, Summer 2006.*
3. *"Myths and Misconceptions About Concrete Hardeners" Phillip Smith: L&M Construction Chemicals, Inc. News, Fall 2001.*

IPCI Project Highlight

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- ***Agg:*** *Small agg*
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