

Day One

Our first day opened with a placement of the fountain slab. It is our example of a fully closed detention basin, with impermeable barrier under the detention basin that holds three feet of water and stone, below the manhole. Some might think of this design as perfect construction for a horse stables or other nasty spills. Our fountain slab uses this detention to capture storm water as well as water that spills from the fountain.

Presentations were made about the municipal, dot and federal entities that the pervious designer will encounter. Mike Bledsoe, Brian Lutey and Phil Kresge have likely experienced these challenges with helpful advice about the opportunities as well as the obstacles that a pervious designer will find.

Mike operates upstream from Peugeot Sound in Washington, where enviro-conscious people carry the day. Some of the demands made by municipal groups may seem unreasonable but most are easily met if we understand the function of the complete system and the limitations of each component part. Mike pointed out ways to spot designs that are inconsistent with pervious pavement systems. This is the starting point of negotiations where we must remain legally defensible. It comes from communication that aligns the owner's expectation with the realities of this type of pavement. Anything that is inconsistent should be addressed well in advance of the test panel placement and the pre construction meeting.



One important part of the system design is the design of the pervious concrete mixture. Here again, many specs are written for pervious that are not consistent with our construction practices, including the production. Brian Lutey addressed the issues of mixture specification and how to negotiate variance to a bad mix specification. When given the chance to compare a troublesome mix to a manageable mix, the client usually agrees to revise the mixture. It is important that they sign off in reference to a certain test panel. This protects the legal interests of the producer as well as the installer and gives better pavement to the owner.

Phil Kresge talked about points in dealing with municipal and dot clients. Bigger pavement is our great ambition but big clients require a lot of tradition and red tape that often relates more to conventional concrete than to pervious. One of our big goals is for everyone to understand the differences between the two, for builders and clients, alike.



Property developers and property owners come in many types. One very interesting one makes a great case study on the previous ownership experience. The LDS Church owns some of the oldest pervious in America. They tend to design their land use to maximize parking area, which requires redesign to meet storm water mandates when it's time to replace the pavement. Mr. Chris Barker, from the LDS Church, talked about their cost comparisons in considering pervious concrete pavement, instead of asphalt. They are already experienced with the process of "patching the patches" associated with the ownership of asphalt. Now, the replacement cost exceeds the price of a pervious concrete system. Chris generously helped us at the Roast and offers his specs and prints for others to use. Watch for these in the downloads at bunyansprings.com. Thanks, Chris and also to his sweet wife, who was drafted when we needed her to direct traffic.



We also placed a decorative panel with a palm trees pattern tooled into the surface. Jim Miller was tooling, stamping and colorizing various pieces of pervious and he insisted that we reduce the powder content to 490 for the tooling process. A layer of 2 mil sheeting is used to hold the pattern guidelines and limit the moisture loss. Also, this thin sheeting forms a radius on each side of the joint. This process requires very pliable paste in the mixture that is kept alive with a hefty 15.7 oz/cwt of Delvo, hydration stabilizer. It also helps to have some shade and fog for the process, too.



Since we are running these mixes heavy, certain disagreements were voiced among our distinguished judges. It makes a great illustration of the types of trouble we face with troublesome aggregate gradation and low DVC.

Cross Rolling

I cross rolled the fountain slab, myself. In fear that excessive cross rolling might close the surface, I barely touched it with one, light pass. However, Brad Roderick, from Momentive, could not stop the crew from repeated, excessive passes and in one pass, a fat guy actually rode the cross roller across the slab. This not only closed the voids at the surface, but also made a nasty drop in surface elevation. The Hexicrete slab maintained acceptable infiltration (125 in/hr) in one area where cross rolling was moderate.



The Pervious Plus slab was also cross rolled in excess. No extra weight was added but the cross rolling was repeated. This amount of cross rolling would be normal for mixtures of higher void content. However, if DVC is as low as 15%, the voids have nearly closed during the compression of the screed and excessive cross rolling is enough to finish them off. Only moderate cross rolling was done on the roasted section of the Pervious Plus slab where infiltration showed an acceptable 153 in/hr.



Aggregate Voids

Many disagreements arose regarding aggregate voids. One part of us was holding firm on the voids calculation of the ASTM C-29, by the book. Others were saying that the real limits of available space for the paste are quite different in this aggregate than the gravimetric calculation of the solids would indicate. These two views are illustrated in lines 23 and 24 in the load report, comparing the DVC based on aggregate voids to DVC based on wet voids. This might be the most useful nugget that I can offer. Don't presume to know the void content of aggregate without verifying it with a wet voids calculation. The DVC of the Pervious Plus mixture should be 18.4%, based on the aggregate voids. But, if you base the DVC on the wet voids, it yields only 15%, the point at which we lose sufficient connectivity to drain the pavement.

Water

As we operated with mixtures so heavy and tight, recurring disagreements arose over added water. Most of us prefer a wetter mixture. But, being so dangerously close to closing the voids, brings out differing degrees of "hydrophobia" as we want more water but are afraid to use it. An increase in DVC would cut down the haggling over "when to say when".

Fly Ash

We have numerous reasons to use fly ash and these goals are reached differently with different types of ash. Our judges from flyover country use type C and they dose it around 10%. Others who use type F like to dose it around 20% to reach the desired outcome from hydration as well as texture and workability. We intend to research this further and have enlisted the help of the producers of ash in developing recommended practices for use in pervious mixtures.

I was impressed by the ranks of unpaid slaves that generously gave their time and their talent toward a better event. Lonnie Gray, from JB Parson and Brian Lutey, from Ozinga are greatly appreciated for their work and their willingness to volunteer. Others volunteered on the spot, like Max Berry, Reuel Cyr, from Helena Sand Gravel and Matt Cockerham, from North Star Foundations pitched in on every task. Some artists appeared and Jim Miller, from the Bean is one of our favorites. Cal Jeske, from SC Canada, did some colorized surfaces for our "Man of Sloan" banner. Cal also brings a lot of good ideas to our event with different approaches for evaluating infiltration and for cylinder compaction.



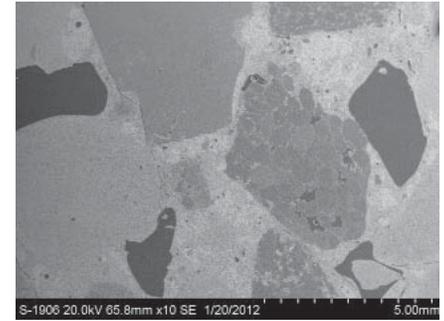
Day Two

We took our first look at Pervious Plus NP during the 2010 Bunyan Pervious Roast. This year we gave Guy Collignon a tougher challenge with a heavy mix proportion, so we are not critical about infiltration. Our main interest in this product is in reducing the risk of exposure during construction and curing. Our industry recognizes the need to protect the slab in a way that is easier than handling poly sheeting.

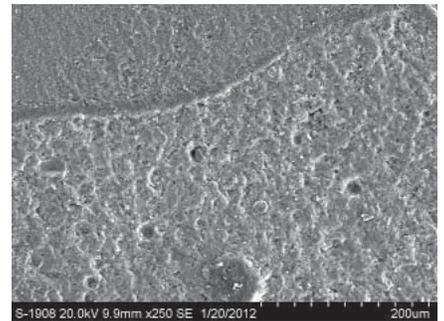
Pervious Plus NP and Hexicrete show promising results in developing strength. But, I still don't think we have enough confidence to leave the pavement exposed when an elevated threat is present. The environment of the construction site should be evaluated to anticipate the level of threat where concrete may be dried or accelerated beyond reasonable limits. If the decision is made to expose the pavement without sheeting during the first seven days, certain practices should be used in dry and windy conditions. Humidity lower than 55% and / or wind above 5 mph constitutes an elevated threat and should require measures toward traditional curing practices.

Some recommended measures might be:

- * **Fog & Mist** A series of nozzles may be installed at the site, on or near the pavement.
- * **Drive-by** Leave an open lane next to the pavement for water trucks to access the area and spray the pavement surface. Repeat every few hours.
- * **Short Sheet** Install poly sheeting as normal, remain in place for 18 hours. Then, advance the sheeting to new slabs placed daily or collect the sheeting.
- * **Bean Oil** A spray application of soybean based penetrating cure will inhibit evaporation.
- * **All of the above.**



Pervious Plus, September 2010
Images by H.J. Brown, MTSU



The Main Event

Few attended this event expecting a fun time. All came expecting to learn and share. I saw it happen last year and tried to prime everyone to give freely of their experience and elevate the industry to our challenges. The evolution of pervious is at hand and it happens in small groups, on subjects that we face every day that we design, produce and construct this pavement. The realities of our limits and the encouragement of better practices are found in these little breakout groups. They are spontaneous and they draw on the experience of guys like Jereme Montgomery, Frank Koseliski, Kirk Havranek, Alan Sparkman, Bruce Cody and Colin Lobo, who came prepared to share.

Official

The Bunyan Pervious Roast offers a broad spectrum of topics which are outside the official, established and recommended practices for method as well as for materials testing. We enjoy the support of Walt Flood, from Flood Labs and ASTM to help us stay on track with the official practices. But, he also advises evaluates our activities which explore the unique and unusual properties of pervious concrete. We hope to influence the eventual practices for evaluation and acceptance for pervious materials. Infiltration is easier to evaluate, but greater challenges exist in aspects of abrasion and strength.

As modern pervious concrete has evolved from a zero slump product, to a flowable product, our collection and formation of the cylinder specimen should preserve the integrity of the paste. The stability of paste is very different between pervious of zero slump and flowable pervious, pertaining to paste migration. The normal practices of sample compaction which include pounding or vibration will commonly cause a downward migration of paste, within the sample.

Cal demonstrated cylinder compaction with a hammer drill as an alternate to compaction done with a Marshall hammer or a Proctor hammer. The target density was easily reached and Walt verified that the weight was right on. However, my keen and discerning eye found clear and noticeable concentration of paste at the bottom of the sample. I would not suggest that we adopt a method, just because it's easy. That's my problem with hammer packed cylinders of any kind, for modern pervious.

Our first muffin press was introduced in 2010 and the containment cans were a dismal failure. But, this tragedy resulted in the accidental discovery of cans that allow compression from both ends and the muffin press now allows us to easy compress the sample just short of the pressure required to shatter aggregate. These muffins reach nirvana when you can't tell top from bottom and the data shows more consistency.

We want to offer a long list of reasons for people to own our hydraulic equipment. But, that is not the ultimate goal for the muffin press. I am currently working on a new version of the muffin press that combines the finer points of an ammo reloading press, a handyman jack and a garlic press that will mount to the receiver on your trailer hitch. All in due time.

Another great tool in our evaluation of modern pervious is the slump cone. For two years I have declared that if mixtures were brought to slumpable moisture, producers would be forced to moderate powder to remain permeable. If you use the cone for both slump and run-out, you can gain great evaluation and familiarity with your mix components.



Day Three

Jim finished up the palms, colored with bean oil. Along with Cal's blue lettering, I wanted James Conway to show decorative grout application with a stencil. We think this has great possibilities for decorative pervious to be applied with logos and decorative patterns. Stand by for more developments on this front.

Tony Kojundik, from Elkem offered some protest about our mixtures causing his demo to lose infiltration. I don't think he was looking for sympathy and I certainly offered him none when I responded, "welcome to the real world, you can expect the masses to misuse your product exactly as you see, here.". Honestly, the more we know about paste density and particle packing, leads us to like micro silica in combination with nearly every other admixture. We have adopted its use in most mixtures where funding permits. We limit the proportion of micro silica to 4% in cement replacement and find its abnormal demands for water to be tolerable. A micro silica pervious mixture shows increased lubricity and thus requires careful attention to DVC and excessive compaction to preserve permeability.

Giants

A critical link exists where a producer shows great skill with his product and connects that skill with contractor / client. I have long admired this ability in certain producers to engage with the builder using elevated expectations, then help him rise to those challenges. David Frentress is a prime example of this, in action. Dave, along with guys like Lutey and Gray tend to bring out the best in us.

We wanted to demonstrate the two-tier pavement method that is favored by our Chinese partners, starting with a structural course for men only. After the structural course was placed and struck off with our chopper tube, the colored wear course was placed on the fresh surface. It looked good to me. But, Mr. Wang mentioned that if I had done that on his job, I would be fired! I look to him for more direction. The concept of multi-layered pavement has great merit in remaining cost effective in using integral color in high doses, or for exposed aggregate pervious flatwork.

I have made numerous claims about the limitations of the motorized roller screed in performance of compaction. I have hounded Dr. Lobo about my theories, attempting to verify this with an accessory for the mortar penetrometer. I got my big chance to demonstrate this to the Doc, showing surface density on freshly struck pervious. The diameter of this accessory is 4 inch and it reaches pressures toward the high end of the scale on the instrument. We might find this more representative by using a smaller diameter. We'll try 3" diameter in our future demos.



I wrapped up things showing fog nozzles and the Kestrel portable weather station, then we filed into the conex to see Wang's power-point. I have had opportunity to work with his men during preparations for the 2008 Olympic games. However, since then, the body of work done by Jadescape and Orangestone has become most impressive. In both aspects of durability and of decorative features, their flatwork exceeds anything I have seen elsewhere.

Mr. Wang and Mr. Zhou are kind and patient with me, as they showed their best work. We listened to the AC roaring while he explained his method and showed his fabulous photos. As we came to images showing steel trowels, one of us mentioned that steel trowels can sometimes seal the surface and caution should be observed. Wang agreed, then mentioned that he also uses a motorized pan float for surface uniformity and durability. I glanced at Nate, Lutey and John Bazella as nobody said a word. We just took a moment to listen to the AC and ponder WTF (winning the future). You should certainly watch for more developments on these pan floated surfaces.

I'll say it again, thanks to all of these guys who brought what they have and shared it so generously. Let's do it again, sometime soon.
David C. Mitchell



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