

First, thanks to all who helped organize and those who attended the 2011 Bunyan Pervious Roast. I appreciate what you did and shared with us at this gathering.

Next, I must apologize for a goof in the misuse of the term "internal cure". I applied this term in describing admixtures which aid with curing issues without realizing that the term "internal cure" is used and defined by the American Concrete Institute. The ACI limits this description to things that actually elevate moisture content within the physical components of a mixture rather than any reference to admixture function. Whatever you do to make good concrete, proper curing practices will make it better.

I will avoid the use of the term "internal cure" unless we are talking about lightweight aggregates or possibly cellulose fibers. The installation and disposal of poly sheeting makes us all yearn for an integral admixture that will allow full exposure, without the use of poly sheeting. While the performance of these admixtures may provide suitable strength and durability while standing alone, I still believe they are made better with full curing practices applied. I don't mind upsetting my friends among admixture producers but I remain on my best behavior at ACI.

Having said that, these types of admixtures offer great features in reducing the risk of dehydration in the mixture. They may also allow placements which may need more time for tooling and color or the constraints of working in highway traffic. They seem to be in a category all their own and I will speak of them as hydration aids or evaporation inhibitors. Also, some of these products seem to enhance workability, which also helps in mixing and discharge.

We examined admixture products from Pervious Plus and from Momentive which are of this type. Dr. H.J. Brown, from MTSU has agreed to help us examine these cores, cut from roasted sections, for evidence of successful hydration. The slides from these pervious mixtures will also be compared to the control batch for paste density, a very desirable attribute when used in freezing conditions with deicing salts.

Paste density is our prime focus on the micro-silica mixture presented by Elkem. The water management aspects of micro-silica made some people surprised that we are using it in pervious mixtures. Management of water is easy enough within the slump range that we enjoy, but this product has an interesting effect on compaction. The paste seems to have increased lubricity which aids the movement of aggregate during compaction. Certain limits of compaction forces from machinery and hand tooling must be observed when installing pervious mixtures contain micro-silica.

These "value added" products are compared to our control batch of "generic pervious". This mixture is defined as being produced by any ready mix facility, with minimum admixtures that are readily available. We chose BASF admixtures for our generic pervious control batch for a few reasons. BASF is on the shelf at the Cal Portland Sloan #3 facility, where our mixtures are batched. The main admixtures include hydration stabilizer, which was invented by BASF. The Polyheed, Navitas and Delvo all

fit the description of basic, affordable components of the generic pervious concrete mixture.

As is often found in real life, we were faced with the option to use #89 stone or bring in special aggregate that is handled and batched outside the normal operations at the batch plant. I want to show what our industry faces, routinely. A producer will read somewhere that we use #89 stone. He will read somewhere else that we add 150 pounds of sand to the mix. Another source will tell him to always use at least 630 pounds of cement. He will then find a contractor with the lowest bid and presumes he is good to go.

It is easy enough to make pervious work well when all of the right materials are readily available and all of the specs are aligned. However, many producers have limited supply of available aggregate gradations, gradations that are designed for conventional concrete. Even though they could access other stone, the realities of handling anything less than a few hundred tons would drive their price up, considerably. The realities of remaining competitively priced against asphalt will force the producer to use what is already active in his normal operation.

During the Roast in 2010, we introduced mixtures with 500 pounds of powder, a drastic reduction in what many considered to be minimum of 630. A couple of us went under the bus, simply refusing to accept such low cement content. It is critical to moderate the powder in order to effectively manage water at high enough moisture levels in the pervious concrete mixture. Typical #89 stone will contain 38% voids and often works well with 500 pounds of powder. However, #89 stone varies greatly. The nice, clean #89 stone that is in the supply during 2011 is now at 34%, and gradations are still within spec. For conventional concrete, this is no big deal. However, for pervious it requires a big reduction in paste volume. To sell pervious made with aggregate of this type, less (440 pounds) powder is required. Everyone stay on the bus because there is a fork in the road and we will take the one less raveled.

In case anyone suggested starving the mixture of water, don't even think about it. As producers attempt to build mixtures that are overloaded with powder, using aggregate with excessive fines, and withholding water to keep the voids open, they arrive at the place where our industry has hit the wall. I want to make a plea to Dr. Colin Lobo and the ready mix industry, to help us reduce these mixes that are overloaded with powder. I don't want to lose anybody by suggesting that we reduce to 440 pounds. But, I believe less paste is required to use aggregate of this type.

These limits usually give us reason to keep shopping for different aggregate. Here is where we find a typical source for closely graded aggregate, regrettably, from the asphalt industry. Asphalt aggregate is brought to a gradation that is unusual to concrete aggregate, but very near perfect for pervious concrete mixtures. We could make our own ideal gradations for pervious. But, in reality, the special handling of such is not going to be cost effective until the concrete industry comes to sell a lot more pervious than we currently sell.

I sometimes petition the group to ban the practice of adding sand. I always ask others to explain their reasons and ask how accurate their batch equipment is in metering small amounts of sand. We often disagree about what level of aggregate voids would require added sand but I still say, only above 42%. And, don't get your hopes up about metering out small amounts of sand with conventional batch equipment. The potential for failure due to excessive sand from such practice is great. But, above all, don't add sand without first measuring the voids in the stone!

I encourage everyone to think outside the box. Not to lead anyone astray, but some variations of the aggregate voids calculation might be useful for pervious materials. Rather than using aggregate that is oven dry, run the material directly from the stockpile, do it early and do it often. Determine the aggregate moisture content and adjust the specific gravity to reflect the moisture. After having filled, rodded and noted the weight of the sample, fill the measure with water and note the additional weight that was added to the voids. This will give another indication, aside of the gravimetric calculation of solids in determining void content of the aggregate.

Before closing the 2011 Bunyan Pervious Roast, we wanted to leave Cal Portland with two good mixture combinations to offer their pervious clients. The #89 stone from their normal supply was used with 440 pounds of powder with acceptable performance. We also placed a mixture made with asphalt aggregate and 500 pounds of powder, with excellent uniformity and ease in handling. Both of these pervious mixtures have good strength and permeability. But, these are not mixtures that are typical to our industry. Relatively few producers observe the limits of proportion in pervious mixtures. Most producers continue to overload their product with powder and sand. We challenge the ready mix industry to understand their materials and develop practices that are specific to pervious concrete.

Designed Void Content  
Cylinders, Cores  
Decorative  
BIRD Update  
Maintenance & Repairs