New Eco-Friendly Concrete Leaks – In a Good Way

Paved surfaces - they're so widespread and common that few of us think much about their effect on water quality and the environment. The reality is that as more land is paved, more rainwater falls on that pavement rather than soaking into the ground. Traditional paving techniques create "impervious" surfaces, that is, surfaces that can't be penetrated by water. The results of an increasing amount of impervious surfaces include erosion, flash floods, depletion of the water table and pollution.

The obvious solution to these problems would be to simply stop installing impervious surfaces. If only it were so easy. But wait! What if there was a material that was as durable as traditional paving techniques that would capture rainwater and allow it to percolate through to the soil below? What if there was a material that would actually assist percolation instead of preventing it? Such a material does indeed exist. It's called pervious concrete, also known as porous or permeable concrete.

Pervious concrete is a mixture of coarse aggregate, cement and water. It contains little or no sand. The cement and water create a thick paste binding the aggregate particles together, but with many voids and spaces between them. This creates a system of highly permeable, connected voids, usually 15%-25% of the structure, that drain very quickly. Pervious concrete allows 3 to 8 gallons of water to pass through each per square foot of material per minute, although the formulation can be changed to double that amount if needed.

The strength of pervious concrete is limited due to the high porosity, but it has sufficient strength for many applications such as hardscaping, low-volume pavements, alleys and driveways, low-water crossings, parking lots, sidewalks and pathways, patios, etc.

Pervious concrete has the capability to help recharge groundwater and reduce stormwater runoff. By doing so, it reduces the need for retention ponds, swales and other stormwater management techniques.

An excellent example of the use of permeable concrete comes from the City of Chicago. The city contains 1,900 miles of public alleys, the equivalent of 3,500 acres. Most have neither drainage structures or a connection to the sewer system. After years of degradation, localized flooding became a problem. As a result, the City developed the Chicago Green Alley Program to use and promote best management practices in stormwater management. The goal was to address drainage issues without costly sewer infrastructure improvements.

To accomplish it's goal, the Green Alley Program combined sustainable building techniques such as recycled materials, reflective pavements, energy-efficient lighting and permeable paving to reduce the amount of stormwater runoff put into the stormwater sewer system by 80%, reduce localized flooding, and reduce the urban heat island effect.

Light-colored, pervious concrete, made with recycled materials, was chosen as a component of this program for it's durability and environmentally sustainable properties. In this situation, pervious concrete allows stormwater runoff to percolate into the soil and reduce the stormwater load going into the City's sewer system.

Engineers and architects are beginning to view pervious concrete as the preferred method of managing stormwater. The ability to manage stormwater on confined commercial sites without retention or detention facilities, also gives developers an advantage. Residential developers are also beginning to find ways to use pervious concrete to make their projects greener while reducing costs. Rather than pay for infrastructure to move stormwater to retention facilities, these developers can allow nature to replenish the water table directly. The reduction or even elimination of retention facilities allows these developers to lower costs while providing extra room for green space.

In Michigan, a homeowner had a poorly constructed driveway which caused minor flooding in the garage. The traditional solution would be to rip out the entire driveway, re-grade and re-install. The contractor involved however, suggested removing only 1/6 of the driveway near the garage and putting in pervious concrete to solve the problem. The water that would have flooded the garage now flows down through the permeable concrete into the soil below. This solution cost only a fraction of the cost of the alternative.

Acceptance of pervious concrete has been widespread. The EPA now recommends pervious concrete as a Best Management Practice for the management of stormwater runoff on a regional and local basis. In addition, the National Ready Mixed Concrete Association (NRMCA) now has a National-level program in place to certify contractors in the installation of pervious concrete.

Pervious Concrete Resources

Demonstration videos:

http://www.concreteresources.net/cd/
http://www.concretenetwork.com/pervious/video.html

Portland Cement Association, Pervious Concrete: Hydrological Design and Resources (CD), CD063, Skokie, Illinois, 2006. http://www.cement.org/bookstore/profile.asp?itemid=CD063

Portland Cement Association, Pervious Concrete at the LEED™-Certified East Atlanta Library (video), CD067, Skokie, Illinois, 2006. http://www.cement.org/bookstore/profile.asp?itemid=CD067

Storm Water Phase II Final Rule: An Overview, EPA 833-F-00-001, Fact Sheet 1.0, US Environmental Protection Agency, Office of Water, January 2000, 4 pages. Available at: http://www.epa.gov/npdes/pubs/fact1-0.pdf.

Tennis, P. D., Leming, M. L., and Akers, D. J., Pervious Concrete Pavements, EB302, Portland Cement Association, Skokie, Illinois, and National Ready Mix Concrete Association, Silver Spring, Maryland, 2004, 25 pages. http://www.cement.org/bookstore/profile.asp?itemid=EB302

Southeast Cement Association, Pervious Concrete Pavements Website: http://pervious.info/

About the Author

Mary Smith is a freelance writer. She heard about pervious concrete from the talented design team at **Florida Engineering Solutions** (www.florida-engineer.com) . They do structural engineering design, not construction. When you need state-of-the-art engineering solutions, remember FES.

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