The Use of Permeable Friction Course (PFC) Pavement for Water Quality Improvement

American Association of State Highway and Transportation Officials
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Roadway storm water runoff may contain a number of undesirable pollutants.

The Challenge

Streets, highways, and bridges can be sources of pollutants to our nation's waters. Contaminants from vehicles and activities associated with roadway construction and maintenance tend to be washed from roads and roadsides when it rains or snow melts. A large amount of this runoff pollution is carried directly to water bodies.

In December 2009, EPA announced plans to establish a comprehensive program to reduce stormwater discharges from new development and redevelopment and make other regulatory changes to strengthen its stormwater program. This, and other developing national and state stormwater regulations, are increasing the nationwide need for effective and economically feasible post-construction storm water treatment strategies. Storm water runoff quality is seen as a critical issue in the future by AASHTO's Standing Committee on the Environment (SCOE).

Monitoring funded by the Texas Department of Transportation (TxDOT) has demonstrated up to 90 percent removal of the pollutants in highway runoff. This degree of treatment often allows TxDOT to meet water quality requirements without the need to build and maintain permanent storm water treatment controls.

What is Permeable Friction Course?

Permeable Friction Course (PFC) is a porous asphalt overlay that is applied over conventional concrete or asphalt pavements. During storms, the rainfall infiltrates into a PFC pavement and is conveyed along the boundary with the underlying conventional pavement to the edge of the roadway. This configuration keeps the underlying base material from getting wet and distinguishes this material from fully porous pavement sections.

A New Use for an Existing Technology

Historically, permeable friction courses (PFCs) have been used by DOTs to improve safety, because the drainage characteristics reduce surface sheet flow and thereby eliminate splash and spray associated with vehicles, improving driver visibility. Drainage within the pavement also reduces the possibility of hydroplaning.

What has not been widely recognized is PFC's ability to improve the quality of highway runoff. Monitoring funded by the Texas Department of Transportation (TxDOT) has demonstrated up to 90 percent removal of the pollutants in highway runoff. This degree of treatment often allows TxDOT to meet water quality requirements without the need to build and maintain permanent storm water treatment controls. Monitoring in Texas and North Carolina also indicates that the water quality benefits persist for the structural life of the pavement without any maintenance. Since this pavement type is widely used solely for the safety benefits, the water quality improvement is essentially cost free. In addition to meeting specific water quality performance criteria, this pavement can also be used in National Environmental Policy Act (NEPA) documents and to demonstrate mitigation under numerous water quality regulations.

How does PFC Filter Pollutants?

According to the report *Effects of a Permeable Friction Course on Highway Runoff* by Michael E. Barrett:

> It is reasonable to expect that the amount of material washed off vehicles when driving in the rain will be reduced as PFC reduces splash and spray. This reduction in the amount of material washed from vehicles is expected to decrease the concentrations of these pollutants in the runoff generated from roads paved with PFC.
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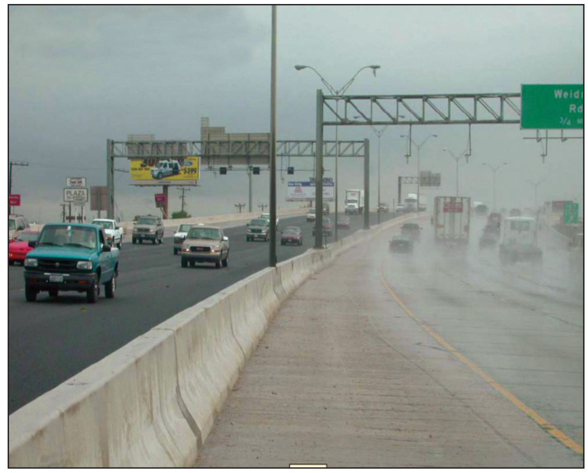
> The porous structure of PFC also may act as a filter of the storm water. Runoff enters the pores in the overlay surface and is diverted toward the shoulder by the underlying conventional pavement. Pollutants in the runoff can be filtered out as the water flows through the pores, especially suspended solids and other pollutants associated with particles. Filtering occurs when pollutants become attached to the PFC matrix by straining, collision, and other processes. Material that accumulates in the pore spaces of PFC is difficult to transport and may be trapped permanently. On the surface of a conventionally paved road, splashing created by tires moving through standing water easily can transport even larger particulate matter rapidly to the edge of pavement. However, water velocities within the pore spaces of the PFC are low and likely could only transport the smallest material.



The use of permeable friction course (installed on the roadside to the left) reduces splash and spray.

Implementation Facts

PFC surfacing costs are somewhat higher than those for conventional pavement, however this difference would easily be offset if storm water treatment structures are avoided in the design, construction, and maintenance of the project. The effort to plan and build PFC pavements is no different than for other roadway surfaces, so its deployment by other organizations could be immediate. A substantial amount of resources are currently available. As mentioned previously, TxDOT and many other states already have approved PFC mix designs and construction specifications. One thing that substantially improves the ease of deployment is that the same equipment is used to install PFC as is used for conventional hot mix asphalt, so no additional equipment is needed by either the DOT or contractor.

Resources

Project 0-5520 Task 2 Technical Memorandum, Michael Barrett, Center for Transportation Institute, February 17, 2010

Optional Enhanced Measures for the Protection of Water Quality in the Edwards Aquifer (Revised), Texas Commission on Environmental Quality, September 2007

Effects of a Permeable Friction Course on Highway Runoff, Michael Barrett, Journal of Irrigation and Drainage Engineering© ASCE, September/October 2008

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