Wisconsin Permeable Pavement Evaluation

Recipient: Wisconsin Department of Natural Resources
Grant: $79,918 PIs: William Selbig, PhD and Roger Bannerman
Completion: 2018
Fact Sheet 14

icpi
Foundation for
Education and Research

Background and Need

In 2004, the Wisconsin Department of Natural Resources (WDNR) first published permeable pavement guidelines for full and partial infiltration designs. These conveyed pollutant reduction credits for various pollutants. A research question later arose on the extent to which no-infiltration designs reduce pollutants. Moreover, is it of such significance such that WDNR can offer pollutant reduction credits to those who use no-infiltration permeable pavements? From a wastewater treatment perspective, passing stormwater runoff over open-graded aggregate is like a trickling filter in primary sewage treatment.

In 2104 WDNR and industry collaborated to build and monitor pollutants from a site in Madison, Wisconsin with pervious concrete, porous asphalt and permeable interlocking concrete pavement (PICP). The contributing drainage area (CDA) was a busy asphalt parking lot some ten times larger than the permeable pavements. Runoff from an adjacent, busy asphalt parking lot was directed to the pavements show in the picture below. Three PICP areas are shown in the foreground. Pervious concrete and porous asphalt are in the background as well as the asphalt parking lot.

Pollutant monitoring was conducted from 2015 to 2016. The investment to build and monitor pollutants from the adjacent asphalt parking lot was about $577,000 including funds from WDNR and the Wisconsin DOT, as well as cash and material donations from industry. A project overview and results from USGS can be found here.

USGS and WDNR requested funds from the ICPI Foundation in 2016 to monitor for two additional years with the CDA later reduced from 10:1 to 5:1, the upper limit recommended by ICPI. WNDR received funds from the ICPI Foundation specifically for water quality analysis. WDNR and the USGS donated research staff time whom monitored runoff during all of 2017 and 2018, or just over two years.

Objectives

- Calculate the residence time of the runoff collected in the storage layer during different precipitation events.
- Measure pollutant reductions from outflows after moving through the open-graded aggregate.
- Test how permeable pavement can cool heated runoff during summer months.
- Test how permeable pavement surfaces can reduce the need for road salt.

- Determine how quickly permeable pavement clogs with fine particulates over time thereby slowing the infiltration rate.
- Demonstrate the effectiveness of various surface cleaning methods.
- Improve permeable pavement flow and pollutant reduction routines in the Windows-based Source Load and Management Model (WinSLAMM) using data collected from the study.
- Provide results that will help the Wisconsin Department of Natural Resources amend their WDNR Conservation Practice Standard 1008 for Permeable Pavement.

Outcomes

The WDNR used results from this study to amend standards in Conservation Practice Standard 1008. The results enabled expansion of pollutant reduction credits for no-infiltration permeable pavement design beyond full and partial infiltration designs. Although the study was in Madison, Wisconsin, the results are transferable to any communities mitigating urban stormwater pollution. The project enabled ICPI to better position no-infiltration PICP designs as effective in reducing pollution. This benefit is particularly important in combined sewer overflow (CSO) mitigation that have used partial and no infiltration designs.

Prior to this research, there was little data supporting the pollutant reduction ability of no-infiltration designs as they were used for stormwater runoff storage and outflow rate reductions only. There was no recognition given to pollutant reductions because there was no data from research. That has changed with deliverables from this research.

USGS issued a thorough, peer-reviewed publication for the 2014-2016 study here. The 2017-2018 study report is expected from USGS at the end of 2019. PowerPoint presentations were received from USGS summarizing reduction data and the effectiveness of surface cleaning equipment via before-and-after surface infiltration data. The study has been presented at various stormwater conferences. After a brief hiatus, WDNR has decided to continue funding research with a 3:1 CDA from July 2019 to July 2020.